California. Dept. of Fish and Game.
Biennial Report 1956-1958.

CALIFORNIA DEPT. OF FISH AND GAME

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CALIFORNIA DEPARTMENT OF FISH AND GAME

FORTY-FIFTH

BIENNIAL REPORT

DEPARTMENT OF FISH AND GAME

July 1, 1956, through June 30, 1958

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REDDING
THOMAS H. RICHARDS, Jr.
Vice President
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SAN DIEGO

GOODWIN J. KNIGHT
GOVERNOR

SETH GORDON
DIRECTOR

STATE OF CALIFORNIA
Department of Fish and Game
722 CAPITOL AVENUE
SACRAMENTO 14, CALIFORNIA

October, 1958

To His Excellency, Goodwin J. Knight
Governor of the State of California
Sacramento, California

Sir:

We have the honor to submit herewith the Forty-Fifth Biennial Report, covering the period July 1, 1956, through June 30, 1958.

This report covers in detail the activities of the Department of Fish and Game during that period. Also included are reports of policy decisions by the Fish and Game Commission affecting wildlife, accounts of the activities of the Wildlife Conservation Board and the Marine Research Committee.

A summarization of the many highlights of the period is contained in the Director's Report for quick perusal.

Respectfully submitted,

Seth Gordon
Director

California's official state fish, the golden trout, rendered an scratch board by Socramento artist Paul Johnson. This was the model from which Johnson executed California's first generol fishing license stamp required under legislation passed in the 1957 session.

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STATE OF CALIFORNIA

DEPARTMENT OF FISH AND GAME

GOODWIN J. KNIGHT, *Governor*

FISH AND GAME COMMISSION

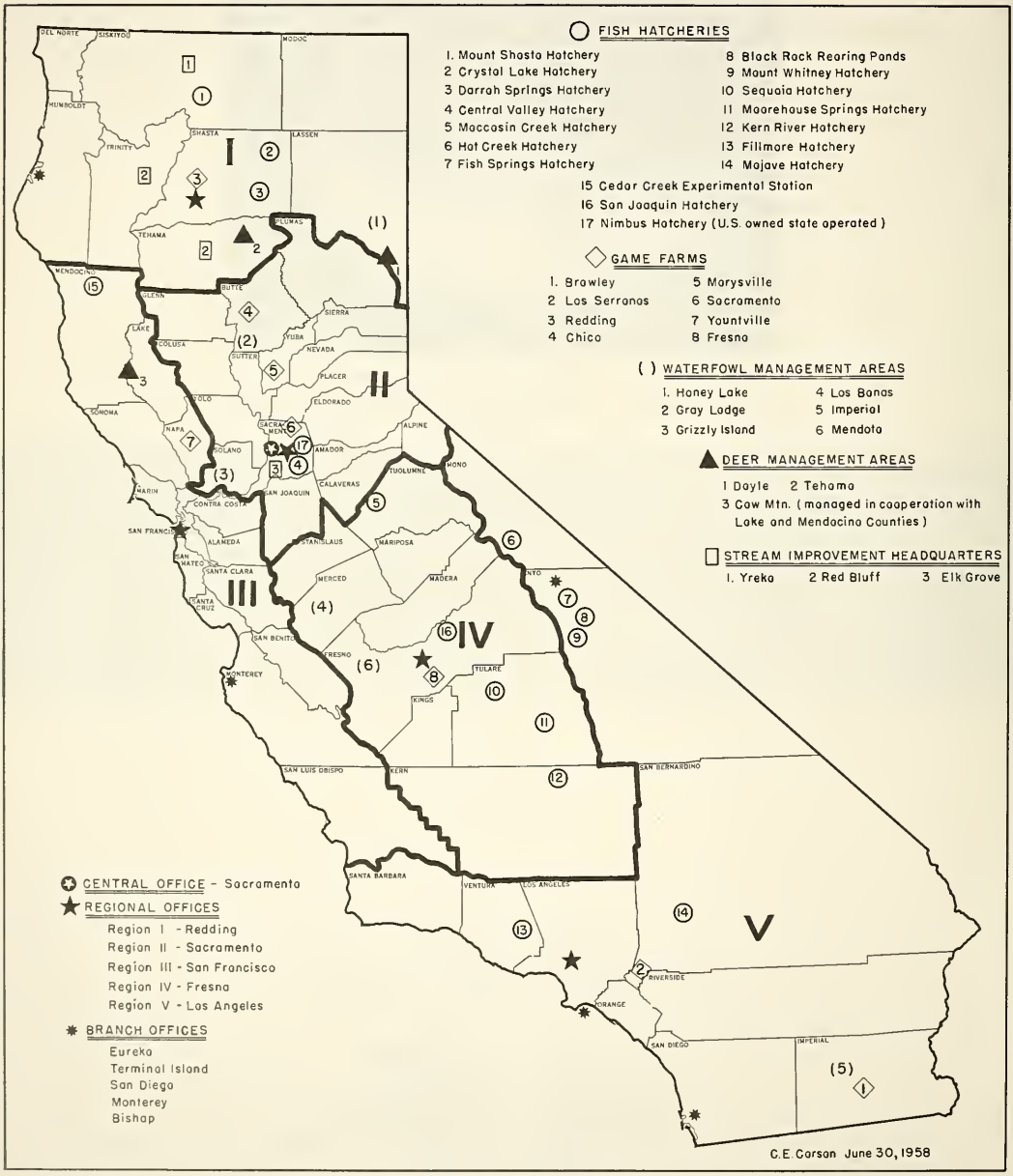
Weldon L. Oxley, President, Redding

Thomas H. Richards, Jr., Vice President, Sacramento

William P. Elser, San Diego Carl F. Wente, San Francisco

Jamie H. Smith, Los Angeles

Department of Fish and Game Major Installations



Fish and Game Commission

The California Fish and Game Commission. Seated is President Weldan L. Oxley. Standing, from the left, are: Vice President Thomas H. Richards, Jr., Carl Wente, Jomie H. Smith, and William P. Elser. This was the makeup of the commission at the close of the period.
—Fish and Game Photo

Major changes in the personnel of the California Fish and Game Commission were made during the biennium by the deaths of two commissioners and the expiration of the term of a third.

Harley E. Knox, president of the commission, died early in the biennium. William J. Silva, a past president, died shortly thereafter. The term of Andy Kelly, president of the commission, expired January 15, 1958.

William P. Elser of San Diego was appointed to succeed Knox and Thomas H. Richards, Jr. of Sacramento succeeded Silva. In January, 1957, Governor Goodwin J. Knight made his third appointment, naming Jamie Smith of Los Angeles to succeed Kelly.

The commission is the body, appointed by the Governor and confirmed by the Senate, which sets down policies for the guidance of the Department of Fish and Game. During the biennium, the commission reaffirmed one key policy and adopted several other important policies.

Concerned with the unsatisfactory aspects of the three-day either-sex deer hunts in 1956, the commission announced the following February that until such time as it is granted authority to control the number and distribution of hunters taking antlerless deer, it will authorize the harvesting of surplus animals on a special hunt basis only.

Deer Management Principles Reaffirmed

The statement of policy also reaffirmed the commission's belief in the principles of deer management as expressed in the California Deer Management Policy it adopted in 1950.

In a resolution offered to the Legislature, the commission said its decisions have been based on scientific research, long-range planning, good management practices and the advice of experts in the field and are aimed at accomplishing the best results on a statewide basis. The Legislature was asked to encourage this, rather than impose restrictions which make it difficult or impossible to conduct sound fish and game conservation programs.

Under new legislation enacted in 1957, the commission in May, 1958, set hearings for three special antlerless or either-sex hunts for July dates. It declined to schedule hearings on 11 other proposed special hunts, but announced it would reconsider if county boards of supervisors submitted formal requests for such hearings to the commission before a June 16th deadline.

The commission said its reason for declining to set the 11 public hearings at the May meeting was based on objections received from supervisors in some of the counties in which the proposed hunts were to be held. The commission said time, money and effort would be saved if the counties desiring such hearings would so indicate. Boards of supervisors of the Counties of Modoc, Inyo, Tulare and Los Angeles asked for the hearings, which were held in late July.

Other Policy Actions

In other important policy matters during the period, the commission took the following action:

Amended its policy on public land withdrawals and applications for such withdrawals to provide for mineral entry;

Adopted a policy calling for multiple use of lands administered by the department;

Clarified its policy in regard to dams and obstructions on the Klamath River.

After two public hearings on a special elk season in Colusa, Lake and Yolo Counties, the commission set a date for the season, then canceled it. Ranchers who control 90 percent of the area proposed for the elk hunt had agreed to open their property to hunters but withdrew their approval at the last moment.

The commission, which is also a regulation-making body under authority conferred by the Legislature, was active in this field during the period.

Regulations Enacted

Annual fishing and hunting regulations were regularly set by the commission during the biennium. The commission also took the following regulatory actions:

Adopted regulations prohibiting the possession and use of wild minnows in certain waters of the state, effective January, 1959;

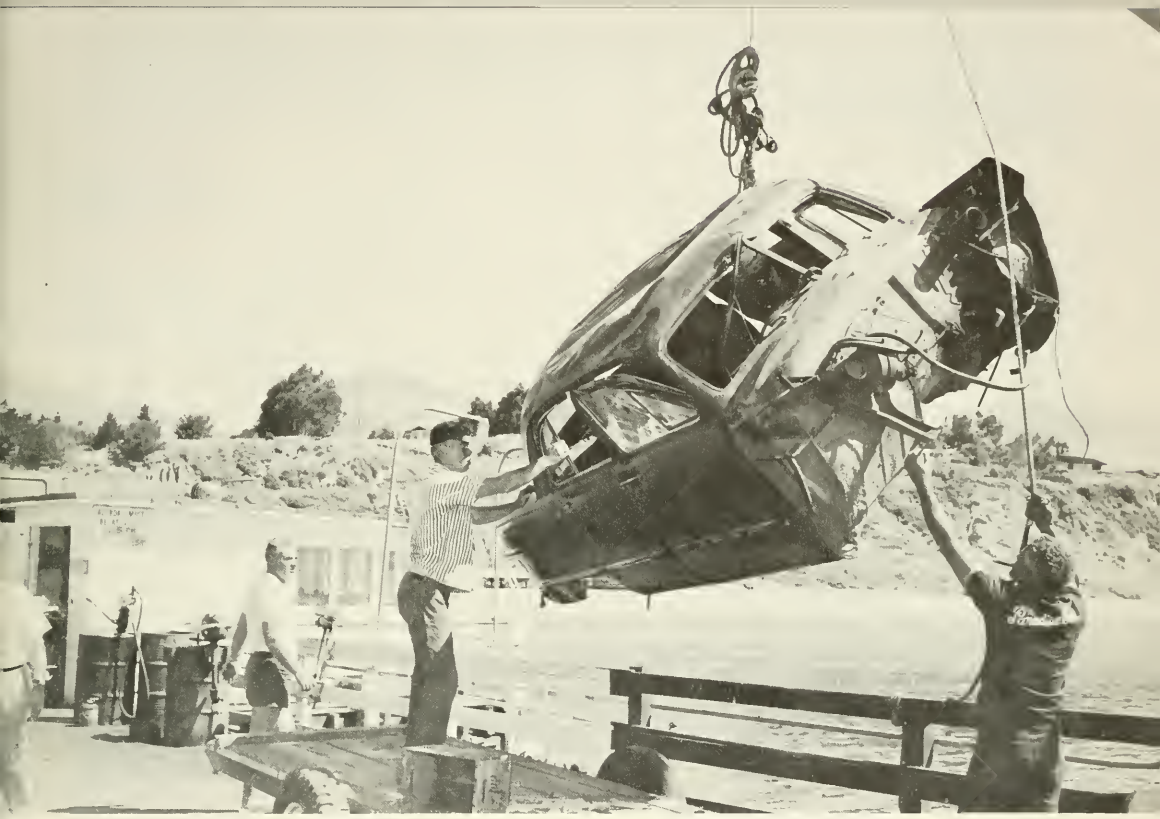
Suspended waterfowl feeding regulations because of a conflict with federal regulations;

Adopted regulations regarding possession and training of hawks used in the practice of falconry in accordance with new legislation;

Adopted regulations permitting the possession of an additional bag limit of trout taken in Inyo and Mono Counties in accordance with new legislation;

Set regulations under which special hunts to reduce crop damage from deer may be held, also in accordance with new legislation.

Report of the Director



New homes for fish! Marine Resources personnel supervise lowering of old car bodies on barges for dumping in offshore ocean areas barren of sport fish. This program was initiated by the Department of Fish and Game to investigate the possibilities of improving ocean sport fishing.
—Fish and Game Photo

Substantial gains in wildlife conservation which will have far-reaching effects on the generations of anglers and hunters yet unborn highlighted the many Department of Fish and Game activities during the biennium.

A marine habitat improvement project, designed to improve ocean sport fishing, was started in May, 1958.

Gillnets, which were the last remaining obstacles to salmon on their spawning runs up the Sacramento and San Joaquin Rivers, were removed by legislative action.

Wildlife conservation received a further boost when the Legislature directed the State Water Rights Board to consider all beneficial uses of water, including fish, wildlife and recreation, in its deliberations.

Public access to fishing and hunting was accelerated when the Wildlife Conservation Board shifted its program to concentrate on these problems.

The department brought its case for more water for salmon in the San Joaquin River before the State Water Rights Board in the Friant Dam hearing, under way at the close of the period.

The department began to study ways and means of improving both state-owned and privately-owned waterfowl habitat.

Unit management of deer (by herds) was instituted by legislation in 1957. The department had recommended this system following experimental management in several regions for several years.

The Hunter Safety Training Program recorded the 100,000th student trained.

Silver salmon were planted in the Sacramento River and a run appeared to be established as the biennium ended.

MANAGEMENT TOOLS PROVIDED

Further advances were made in providing the department with the tools to perform its necessary job of wildlife management. These include equipment, facilities and manpower.

Re-codification of the Fish and Game Code was accomplished during the period.

The department applied for withdrawal for recreation purposes of a half million acres of public land.

New offices in Region 2 (Sacramento) and Region 4 (Fresno) were provided and a start was made on a laboratory building in Sacramento for statewide game and fisheries investigations.

The department's Beechcraft, twin-engine airplane, obtained as war surplus shortly after the war, was sold and a new plane of the same type purchased.

The research vessel "Yellowfin," classified as unseaworthy because of dry rot, was sold and the U. S. Fish and Wildlife Service vessel "Alaska" was leased by the department and outfitted for department duty.

Work began on a new ocean patrol boat to replace the old "Albacore" which was scheduled for sale in the fall of 1958 and a new patrol boat, "Silversides," was purchased for duty in Humboldt Bay.

The department was given increased personnel to deal with the highly complex problems involved in water and pollution laws.

Twenty-five new wardens, approved by the Legislature in the previous biennium, joined the department in the fall of 1956.

Persons who pollute streams are now required to clean them up at their own expense, thanks to legislation passed in the 1957 session.

A statewide radio network solely for fish and game patrol activities was placed in operation.

A new warden training program went into effect when the 25 new wardens joined the department in the fall of 1956. The department-wide training program was extended to all levels, from the newest employee at the beginning level to the top administrator.

An accident prevention program was started late in 1957, involving safety conferences at all levels and designed to make all employees safety conscious. In a few months the accident rate dropped sharply.

A long-range planning program was instituted in 1956 by a planning committee consisting of top level staff and regional personnel.

Those are some of the highlights in the 1956-58 biennial period. Here are some of the details:

Stream Cleanup

The 1957 Legislature enacted a law requiring those who pollute streams to clean them up at their own expense. Heretofore, fines were the only punishment required legally. The new law also provides for fines at the judge's discretion, but makes a cleanup mandatory. Already this has had a deterrent effect on some who have come to realize that the price of cleaning a stream, to the satisfaction of the department, can be many times greater (in the expense of wages, equipment and time) than the amount of a fine.

License Fees

The same legislative session approved an increase in license fees to enable the department to continue its conservation work without resorting to deficit or emergency financing. It was the first increase in such fees since 1948.

The purpose of the increased fees was to permit the department to operate in the black, gradually build up its surplus fund and to provide for expansion of programs.

The first full year under the new revenues found license sales decreasing in numbers from the previous years, with the result that income has not been as great as anticipated when the legislation was enacted. Nevertheless, the increases enabled the department to balance its budget (1959-60) for the first time in five years. The dip in license sales may be only a temporary reaction to the increased fees and may be due largely to the recession of early 1958.

Netting Bill

In point of interest, certainly the "hottest" bill of the 1957 legislative session was the anti-netting bill. Sportsmen, who had been asking the Legislature for many years to remove the nets from the lower Sacramento River, made a convincing presentation in the 1957 session. The result was that the gill nets were permanently removed by law. The department took the position that the nets should be removed because they were taking too many salmon bound for the spawning gravels, and that the nets were their last and biggest obstacle. The department also pointed out that the nets were killing too many striped bass while in the process of taking salmon.

Water Rights

Although fish, wildlife and recreation have long been considered beneficial users of water, the 1957 State Legislature put it in so many words when it directed the State Water Rights Board to consider all beneficial uses—including fish, wildlife and recreation—in the course of its deliberations. This was spelled out in Section 1257 of the State Water Code.

A solid gain in the Water Projects field, and a harbinger of better things to come, was the decision early in 1958 in the American River water hearing. The State Water Rights Board, in approving permits for water diversion, prescribed conditions for adequate flows for maintenance and preservation of fish and wildlife. Even in dry years the flows will be adequate to protect fish life, particularly below Nimbus Dam, for migrating and spawning salmon and steelhead. This was a new milestone in the department's efforts to assure perpetuation of California's fish and wildlife resources. It is, further, one more indication of the wider acceptance being accorded to protection and preservation of fish and wildlife.

Ocean Habitat Project

After considerable planning, the department began a project late in the biennium which was designed to learn methods of improving ocean fishing. With the aid of federal funds, the Ocean Fish Habitat Development Project began with the dumping of 20 old car bodies off Paradise Cove, near Malibu, and a number of large, artificial rocks off Huntington Beach. They were dumped in "desert" areas devoid of fish life to take advantage of the well known fact that fish tend to congregate around sunken ships, rocks and other objects in the ocean.

Administration

A major reorganization of the marine fisheries section was effected during the biennium. The purpose was to streamline operations by realigning responsibilities and functions to provide for greater all around efficiency. The reorganization relieved the Marine Fisheries Branch chief and his staff of the responsibility for operations and enabled them to concentrate their attentions on the highly important business of program planning and co-ordinating, and assisting the director with legislative matters pertaining to marine fisheries. Marine Resources Operations was given the operational status of a region and a regional manager was placed in charge. All salt water operations from Crescent City to San Diego are his responsibility. Reporting to the regional manager are a staff of two supervisors of investigation (one at Stanford and one at Terminal Island), a port captain, a business services officer and a biostatistical supervisor. The new setup is working very well.

The 1957 Legislature authorized a full scale survey of fish and game programs and policies and appropriated $100,000 for the job. A contract was awarded to the management analysis firm of Booz, Allen and Hamilton and the survey was under way at the close of the biennium.

MAJOR PROBLEMS

Many other accomplishments of the agency are reported in detail throughout this publication. Of course, there are always problems and the department has had its share of them. However, while the problems loom large, the gains even in these fields have been significant.

WATER PROJECTS

Except that they have intensified, water problems in the last two years have not differed from those of the previous two. A growing state needs water for its people, its agriculture and its industry. These facts have resulted in continually increasing demands for diversion of water from California's streams. The effects on fish and wildlife would be devastating if the department failed in its responsibility to investigate each request and recommend measures to protect wildlife or mitigate unavoidable losses. Such investigations have taken much time and manpower, but they are well worth the effort. The department has noted a growing awareness of, and sympathy for, wildlife problems among water project builders in the last two years. The department no longer sits around the negotiating table as an unwelcome guest.

POLLUTION

The Dickey Act, which went into effect in 1949, is the governing law on pollution. It is administered through one state and nine regional water pollution control boards. The state board is, in practice, only a general advisory and fiscal body. It does not, except upon appeal, review actions of the regional boards, nor does it have any clear-cut authority over them.

Down through the years there has developed out of the Dickey Act a philosophy of "permissible degradation." This is the philosophy which permits of maximum pollution of state waters short of public indignation. The department has opposed this philosophy whenever it has found the opportunity to do so.

Joining with four other state agencies—the Departments of Natural Resources, Public Health, Agriculture, and Water Resources—the Department of Fish and Game recommended a 15-point program of improvements in the Dickey Act to the Assembly Subcommittee on Bay and Water Pollution.

The gist of the recommendations is that *prevention* of pollution is by far the most expeditious and least costly way of keeping our waters clean.

The agencies have proposed that the Legislature declare that waste disposal in state waters is a privilege, not a right, and that such disposal be so regulated as to achieve highest quality consistent with maximum benefits to the people. The other 14 points detail the manner and means by which these basic objectives may be accomplished.

SALMON

Early in 1957, the department warned that fall king salmon spawning stocks in the central valleys had dropped in 1956 to 200,000 from an average of about 500,000 during the preceding four years. It pointed out that if the annual spawning count did not increase sufficiently in 1957 the resource would be in danger.

In 1957 the combined commercial and sport salmon catch tumbled to 5.5 million pounds from the highs of the two previous record years—11.8 million in 1955 and 11.4 million in 1956.

In 1958 the salmon spawner count dropped to 121,000. The department recommended a curtailment of the salmon sport fishing season as the only immediate measure that could be taken to combat

the shortage, but the Fish and Game Commission rejected the proposal because it was powerless to curtail the much larger commercial catch simultaneously. Only the Legislature has regulatory power over the commercial fishermen.

The critical salmon situation had one salutary effect—it united sports and commercial fishermen in a common effort to try to do something about the salmon problem. Under the banner of Salmon Unlimited, this committee held several meetings before the close of the biennium to organize the group and study the problem. The department pledged its co-operation with the new organization.

Operation "Downstream Plant"

In May, 1958, the department conducted a "quickie" test at the request of this group to determine whether salmon fingerlings could be successfully transported downstream by barge and acclimated to increasing water salinity in a short time.

A group of 2,000 fingerling king salmon, supplied by the federal Coleman Hatchery, were placed aboard a tuna clipper equipped with live bait tanks at Sacramento. River water was pumped through the tanks as the boat drifted downstream, thus providing some of the changing salinity conditions that small salmon experience on their natural migrations to the sea.

The trial run was made only to determine whether it was feasible to transport the small fish in this way and results will be useful in planning future experiments. No attempt was made to check the effects of pollution on the fingerlings. In fact, the boat steered a clean-water course all the way, avoiding areas suspected of being even slightly polluted.

Salmon Program Reorganization

Early in 1958 the department began mapping plans for a reorganization of its salmon program. Divided for years past both administratively and operationally between the Inland Fisheries and Marine Resources functions, the plan at the close of the biennium was to place all salmon operations and research under the Marine Resources function, headed by the branch chief. This proposal was ready to be submitted to the State Personnel Board and Department of Finance for approval at the close of the period. Purpose of this reorganization was to concentrate and consolidate all salmon efforts heretofore scattered and strengthen the salmon program by switching personnel from other duties.

EITHER-SEX DEER HUNTS

The first general experimental either-sex deer hunts in California were held in the fall of 1956. The way was prepared for these hunts by 37 prior special hunts, dating from the Catalina Island hunt in the winter of 1949-50.

The commission scheduled the general either-sex hunts for the last three days of the coast and inland seasons respectively, and they were held in 35 counties. It was pointed out at the time that experience gained from these hunts could serve as a guide for future hunts.

While the early hunt went off smoothly, a combination of events resulted in severe criticism of the later inland either-sex season.

Because it afforded the last opportunity for hunters to bag a deer in 1956, the inland season brought out a great many hunters. Storms in the high country touched off movements of migratory deer herds and these movements were given widespread publicity. Such movements at the end of the regular buck season usually bring out many hunters, but this time they had the double opportunity to take a buck or an antlerless deer. The result was large concentrations of hunters were reported in such leading deer counties as Plumas, Lassen, Sierra, Modoc, Tehama, Amador, Placer, Shasta, Butte and Calaveras.

Criticism of the hunts grew out of these concentrations and centered around the bad hunter behavior reported from many quarters as well as the safety risks involved. Road hunting, reckless shooting and trespass reports sprung from these concentrations.

The experience of other states following their first either-sex deer hunts was repeated in California after the 1956 hunts. Reaction against killing of does and fawns, similar in other states, was strengthened by the widespread reports of hunter misbehavior. Opposition formed quickly and made itself felt in the form of deer legislation during the 1957 Session.

Deer Legislation Enacted

The result of the legislation is that only bucks may be hunted on a general unrestricted basis and antlerless deer may be hunted only on a unit-quota, or controlled, system. Spike bucks or spotted fawns may no longer be hunted, although spotted fawns are rarely found during the periods when such hunting will be allowed.

The Legislature provided that antlerless and either-sex seasons must now be ordered on the basis of management units, crop damage, or restricted instances of surpluses only. Unit hunts may be for antlerless deer if held during the regular buck seasons, or for deer of either sex if held at other times of the year. Quotas must be set up for each unit and issued to the public either by drawings or first-come, first-served sale, or a combination of both. In addition, deer are to be managed by herd units and reports on the condition of these herds are made annually to the public by the commission.

Commission Policy Unchanged

Through all the debate on the either-sex deer hunts, the Commission's policy on deer management did not change. The policy, and the department's program, is that the deer population must be balanced with the carrying capacity of its range. Consequently, deer must be harvested by hunters in numbers equal to their annual increase if this program is to be effective. If they are not harvested, they tend to eat themselves out of house and home and can destroy their own range beyond restoration. Harvesting of bucks alone will not keep the herds in balance; hunters must take deer of either sex.

ECONOMIC IMPORTANCE OF FISHING AND HUNTING

In 1955 the department sampled more than 3,000 fishermen and 3,000 hunters with lengthy questionnaires in two separate mail polls to try to obtain some indication of the economic importance of fishing and hunting in California.

Results of the polls were completed and announced in March, 1957, and showed licensed sportsmen in California paid a staggering $487 million to pursue their favorite sports in California in 1955.

By a 4 to 1 margin, this amount overshadows the combined expenditures of all Californians for admission to all sporting events, including professional, collegiate and high school football, baseball and basketball, as well as movies, plays and concerts.

Outlay by Items

Where did the money go?

If you fished, it went mostly for transportation and food and drink; if you hunted, the big cost item was equipment, followed by travel and by food and drink, in that order.

Only 16.5 percent of the fresh water fishing dollar went for equipment, while 29 percent went for travel and 23.7 percent for food and drink. The salt water dollar was similarly proportioned, with 11.2 percent for equipment, 26.3 percent for travel and 20.3 percent for food and drink.

The average California hunter, on the other hand, was primarily concerned with his equipment and ammunition. Cost of travel and of dining were second and third, respectively, on his expense list. Weapons and ammunition formed his biggest outlay (26.4 percent), followed by automobile expense (19.8 percent) and food (17.7).

The survey shows anglers paid only 1.1 percent of their total fishing outlay for a state angling license. Hunters paid 1.7 percent—slightly more because of additional duck stamps and deer and pheasant tags. (For more details, see table 13 in the Appendix.)

CONSERVATION EDUCATION

During the biennium, the potential audience for this increasing volume of wildlife conservation information grew materially by addition of approximately 1,000,000 citizens to the State. The number of conservation education and information specialists, as well as funds available to do the job remain virtually static, however.

Efforts to make the conservation education program more effective by improvement of information materials issued, and their use, as well as concentration on aggressive programs on specific problems such as stream destruction by logging, water pollution and protection of wildlife in water developments were generally targeted at four publics:

First target for departmental information of all kinds are those who work for the department, including volunteer reserve wardens, license agents and hunter safety instructors. All these people, who represent the department officially in varying degrees, are considered keys to informing other segments of the public.

Information to Employees

In employee orientation and training classes, all regular employees are informed of the character, use and availability of all materials published by the department. Information included therein often are subjects for inservice training and discussion sessions. In addition, two periodicals, the Newsletter and Monthly Progress Report, comprising principally internal and operational information, is prepared monthly for inservice use.

The other three targets are: licensed sportsmen, the general public, and future sportsmen. The approach is by two means—special purpose media and mass media, or "rifle" and "shotgun" coverage.

The "shotgun" media are the newspapers, television, radio stations and moving pictures. The department attempts to reach the general public through these media by means of a weekly press release from headquarters and periodic news releases from regions. The department's motion pictures are made available to television stations.

"Outdoor California," a monthly publication of the department, is designed for general newspaper and magazine use as feature material, as well as for broadening the general wildlife conservation knowledge of employees and others specifically interested in wildlife.

The special purpose media are the materials produced by the department to answer particular questions most often asked, or for other special purposes. In this class are the "Conservation Information Folders," such as "Stop, Look and Live," a new folder produced for the first time in this biennium. The folder emphasizes the positive approach to safety in the field, as well as good farmer-sportsman relations. Approximately 700,000 were printed in the last two years and distributed to license buyers through license agents. Similar information also was included for the first time in the 750,000 copies of the Hunting Regulations Digest distributed to hunting license buyers.

Species identification booklets are also special purpose media, as is the biennial report.

"Trout of California" and "Big Game of California" joined the first two booklets in the series (on waterfowl and upland game) during the period. The booklets have a threefold purpose. They are designed to be informational and educational and to provide training to department personnel across functional lines. The biennial report is designed as an easy-to-read report of the last two years of wildlife management and research and is sent to newspapers and leaders in the conservation field as handy reference material. The American Association for Conservation Information honored the biennial report as the outstanding publication of its kind in 1956 and rated "Trout of California" as a runner-up in the species identification booklet category in the same year.

Motion Picture Production

Motion pictures serve the double purpose of reaching the general public through mass media and particular publics through individual showings before small groups, clubs, schools and other organizations.

Three new motion pictures were produced during the biennium. "Tomorrow's Salmon and Steelhead" is the story of the destruction of spawning beds by careless or uninformed loggers. Designed to point out a particular problem, the picture has served to highlight the problem so well that logging firms have begun to take remedial measures to prevent future pollution of spawning gravels. The department now plans to expand this picture to include pollution from other sources.

"Fish in the Sea—facts and fancies" tells the story of ocean research and the problems involved. It was completed toward the end of the period, but already has been widely booked and well received. "The Sea Otter" was completed in the last month of the biennium. It depicts the story of a scarce resources and the need to protect it from human depredations.

In production as the period closed were films on water development and pollution control problems.

Reaching the Future Sportsmen

To reach the school children of today who are the sportsmen of tomorrow, the department uses several approaches. One consists of visits by personnel to schools to discuss particular or general problems involved in fish and game work. The other is by means of department-produced or department-reviewed literature, and the motion pictures.

The four species identification handbooks have been made available to schools through the Documents Section, Printing Division, at nominal cost. They have been well accepted and are gaining in popularity. Natural science books, which contain chapters on fish and game conservation, are passed on by the Department of Education for review before they are published. This presents the department with the opportunity to learn how much conservation material is going to schools and to add to it, if necessary.

HUNTER SAFETY PROGRAM

Inaugurated in 1954, the hunter safety program passed two big milestones during the biennium. Late in the period the 100,000th student passed through the training program and received his certificate of completion of the hunter safety training course.

California was accorded an international honor for having the outstanding program of 1957 among the states and Canadian provinces by the International Association of Game, Fish and Conservation Commissioners. The award, sponsored by the National Rifle Association, is a beautiful plaque known as the "NRA Hunter Safety Award."

Volunteer Instructors Are Key to Successful Program

Most of the credit for achieving both milestones is due to the 2,600 volunteer instructors who serve without pay to instruct students, and to the National Rifle Association who assisted with materials and organization plans to set up the program.

The program began July 1, 1954, the effective date of a hunter safety law which requires completion of a course in safe handling of firearms as a condition for obtaining a hunting license for persons under 16.

Organized in the Conservation Education Section of the department, the program is co-ordinated on the local level by game wardens who guide the work of the volunteer instructors. A hunter safety training officer at headquarters co-ordinates the program.

The program consists of four hours of instruction and results in a certificate of completion awarded to the student upon successfully completing the course.

It is credited with having a great deal to do with the reduction in California hunting casualties from a total of 132 in 1955 to 79 in 1957. Since the program began, its effects have been apparent not only among youngsters, but adult hunters as well.

Wildlife Conservation Board

Typical of access sites provided by Wildlife Conservation Board funds is this one on the Feather River near Boyd's Pump. Under construction in the biennium, the ramp is 22 feet wide and has a two-foot walkway down the left side. Boat docks were built by local sportsmen.

—Wildlife Board Photo

When the Wildlife Conservation Board was created by the Legislature in 1947, it was charged with the responsibility for establishing "a co-ordinated and balanced program resulting in the maximum revival of wildlife * * * and in the maximum recreational advantages."

In pursuance of this responsibility, the board, in the previous biennium, developed a program of public hunting and fishing access which reached its stride in the last two years. This program and the board's warmwater fish program were given top priority after the board decided that its fish hatchery and waterfowl area programs are largely complete.

The finances for the Wildlife Conservation Board program continue to be $750,000 annually from state parimutuel funds. After earlier initial allocations of $9 million in 1947 and $3 million in 1951, the Legislature (in 1955) placed the board on this recurring appropriation basis.

All Wildlife Conservation Board projects continue to be co-operative in nature. Waterfowl areas and hatcheries are turned over to the Department of Fish and Game for operation and maintenance. The public access developments are all operated and maintained by public agencies, such as counties, cities, recreation districts and the U. S. Forest Service. The lakes built

and opened to public use are also operated by local agencies.

Board Membership

The Joint Legislative Advisory Committee was composed of Senators Charles Brown, Ed C. Johnson, J. William Beard, and Assemblymen Frank P. Belotti, Thomas M. Erwin, and Lloyd W. Lowrey. Department of Finance Director John M. Peirce and Department of Fish and Game Director Seth Gordon continued to serve on the board. Weldon L. Oxley replaced Andy Kelly as chairman during the biennium. Everett E. Horn continued as co-ordinator.

WARMWATER PROGRAM

During this biennium, the program of making available to the public existing water impoundments that were either closed to fishing or inadequately developed for public use was intensified.

This has included such projects as the San Diego City Water Supply Reservoirs—Pardee in Amador and Calaveras Counties, Santa Margarita in San Luis Obispo County, Isabella in Kern County, Woodward in Stanislaus County and Avocado Lake in Fresno County.

In addition, new waters have been or are being created for the express purpose of providing warmwater fishing and recreation. Madera Lake, the largest project of this type, was under construction during the biennium. It consists of a 400 surface acre warmwater fishing lake on 1,200 acres and will be completed in 1959. This state-owned facility will be operated and maintained by Madera County.

During the biennium, the board allocated $1,035,000 for capital outlay under this program.

Parking and boat launching area at Santa Margarita Lake, constructed with Wildlife Conservation Board funds and opened early in 1957.
—Fish and Game Photo

Using gill nets and seines, the Department of Fish and Game periodically samples fish populations in the Salton Sea to keep tabs on spawning, survival, food conditions, growth rates and general abundance and health of ocean species from the Gulf of California transplanted here. WCB funds made possible the development of this highly saline inland sea. Here is a carvina, now abundant in the Salton Sea. The department transplanted 2,000 of these as broodstock from 1950 through 1956.

—Fish and Game Photo

ACCESS PROGRAM

A field survey of the Colorado River, the Sacramento and San Joaquin River Systems and the San Francisco Bay area was completed. This survey revealed a considerable need for access to these fishing waters. The Inland Angling Access Program consists of acquisition of land, construction of parking area, boat launching ramps and in some projects fencing, floats and sanitary facilities.

The projects shown in the upper table on page 20 were all in some state of completion or development at the end of the biennium. The allocations were intended to cover the estimated cost of the projects and recoveries of funds can be expected on some of the projects.

Coastal Access

A resurvey of the entire California coast line was completed in 1957. This delineated desirable sites that, if acquired, would provide access to ocean fishing. To date, seven coastal counties have agreed to participate in the program by operating and maintaining any projects acquired in those counties. Land is often difficult to obtain at appraised values. This has resulted in a slower program of acquisition. The 1957 Legislature granted authority to acquire by condemnation where necessary if the county boards of supervisors give approval for such action. This authority was not used during the biennium.

OTHER FISH PROJECTS

Two trout fishing lakes in the Mendocino National Forest in Glenn County were completed and afford fine fishing. Plans were completed and an allocation was made for another trout lake of about 35 surface acres in the same forest to be known as Letts Valley Lake. Legg Lake in Los Angeles County was also under construction during the biennium.

The Salton Sea project in Imperial and Riverside Counties was a co-operative project among the Department of Fish and Game, University of California at Los Angeles, and the Wildlife Conservation Board. The objective was to establish a fishery in the vast Salton Sea. The success of this project was even greater than anticipated and limits of corvina and sargo are now being taken by anglers.

Somewhat similar projects are under way for the improvement of fishing in coastal lagoons.

The Berkeley Pier in San Francisco Bay was leased to the Department of Fish and Game and a WCB project, to make the pier safe for public use, is nearing completion. The City of Berkeley will maintain the pier exclusively for sport fishing.

Waterfowl Management Areas

The only new waterfowl management project for the period was the purchase of the 59-acre Indian Tom Public Shooting Area in Siskiyou County. This land was made available by the State Lands Commission for $1,834.

Considerable development was under way toward the completion of the Lower Butte Creek (Gray Lodge) Waterfowl Management Area in Butte County, as well as the Mendota Area in Fresno County.

For the development and land acquisition of 490 acres at Mendota Waterfowl Management Area there was allocated $107,000. The Lower Butte Creek allocation for development during the period was $124,200.

Fish Screens and Ladders

The Wildlife Conservation Board continued to provide funds for the larger screens on irrigation diversions.

Several fish ladders were completed, the most important being the Woodbridge fish ladder on the Mokelumne River at Woodbridge, and the fish ladder on Clear Creek in Shasta County, a tributary to the Sacramento River.

Probably the most interesting fish ladder completed during the biennium is the Iron Canyon Barrier on Big Chico Creek, near Chico. This rock barrier has blocked fish passage to the spawning gravels above for more than 50 years. Details may be found in the Inland Fisheries section of this report.

Stream Improvement

The stream improvement project in Southern California was continued during the period, but it became increasingly difficut to locate suitable sites for the small dams. By the end of the biennium, it was apparent that the project should be closed. Future projects in this area will be evaluated individually.

The stream flow maintenance projects in the El Dorado National Forest and the Tahoe National Forest were continued. With the projects completed during the biennium, there have been 143 miles of stream kept flowing during the summer and fall seasons. No new money was allocated, but $90,000 was expended during the period.

Inland Angling Access Projects--1956-58

Name	County	Access to	Allocation	Operated by
Julian Wash	Imperial	Colorado River	*$10,880	
6th Ave. Terminus	Riverside	Colorado River	3,800	County
26th Ave. Terminus	Riverside	Colorado River	7,700	County
38th Ave. Terminus	Riverside	Colorado River	4,000	County
Anderson	Shasta	Sacramento River	19,000	City
Balls Ferry	Shasta	Sacramento River	23,000	County
Bend Bridge	Tehama	Sacramento River	23,000	County
Tehama Co. Park	Tehama	Sacramento River	12,200	County
Tehama City	Tehama	Sacramento River	21,500	County
*Reclamation site 21	Glenn	Sacramento River	1,250	County
Chico Creek	Butte	Sacramento River	14,500	Recreation Dist.
Tisdale Weir	Sutter	Sacramento River	2,550	County
Knights Landing	Yolo	Sacramento River	22,000	County
Clarksburg	Yolo	Sacramento River	25,000	County
Yuba City	Sutter	Feather River	20,000	City
Boyd Pumpa	Sutter	Feather River	22,500	County
Suisun	Solano	Suisun and Grizzly Baya	12,500	City
Alameda	Alameda	San Francisco Bay	25,000	City
Vallejo	Solano	San Francisco Bay	25,000	City
Klamath Glenn	Del Norte	Klamath	12,480	County
Lost Lake	Fresno	San Joaquin River	27,200	County

* Land Acquisition only.

Projects Under Development

Name	County	Access to	Allocation
Nick's Cove	Marin County	Tomales Bay-Ocean	$33,100
South Kibesella Gulch	Mendocino County	Ocean	13,000
Heeser Drive	Mendocino County	Ocean	
Elkhorn Slough	Monterey County	Ocean	33,000
Fields Landing	Humboldt County	Humboldt Bay and Ocean	27,250
Crescent City	Del Norte County	Ocean	53,800
Ocean Park	Santa Barbara County	Ocean	16,898
Morro Bay	San Luis Obispo County	Morro Bay and Ocean	21,500

Wildlife Protection

A warden checks a string of bass at Santa Margarita Lake, San Luis Obispo County.

—Fish and Game Photo

Land patrol activities and responsibilities increased during the biennium in many areas as new reservoirs, such as Lake Berryessa in Napa County and Lake Isabella in Kern County, began to produce good fishing within a few hours drive of population centers. Extended quail and pheasant seasons, introduction of bear license tags, lengthened chukar partridge seasons, establishment of a burro sanctuary, an alarming reduction in salmon spawning runs, numerous special deer hunts, and other changing patterns all tended to place additional work upon land wardens throughout the State.

An increase in workload was also experienced by marine patrol wardens as ocean waters gradually received heavier angling pressure. Excellent runs of bonito, white seabass, barracuda and yellowtail in southern waters, an increased number of commercial abalone divers in the central coast area, the dwindling supply of salmon available to commercial fishermen, greater interest commercially in the northern shrimp fishery, and a boom in the sport of skin diving all contributed to the necessity for additional enforcement activities of Marine wardens.

The overall increased hunting and fishing activity also resulted in a sharp rise in arrests during the biennium. While the number of enforcement personnel increased 13 percent, arrests surmounted the previous biennial figure by 30 percent. Some 23,733 hunters and anglers were haled into court during the 1956-58 period and paid the staggering sum of $696,730.50 in fines, an average of $29.36 per errant sportsman.

Although angling license sales dropped only four percent during the January 1, 1958, to June 30, 1958, period when the new angling license stamp require-

Port of a marine warden's duties, as shown above, is checking mesh sizes of commercial fishing nets. —Fish and Game Photo

ments boosted the fee for inland fishing privileges, arrests for fishing without a license increased 25 percent compared to arrests during the same period in the previous year. This one violation led all others with 5,783 cases being processed, or 24 percent of all violations and an increase of 37 percent over the 1954-56 biennial figure.

Leading Vialation

Anglers fishing inland waters were well-informed of the new license stamp provisions which became effective on January 1, 1958, and only 85 citations were issued for failure to have the necessary stamp or stamps.

Hunters (3,058), with apparent disregard for their own lives and the safety of their companions, were apprehended while carrying a loaded shotgun or rifle in a motor vehicle. This one class of violation accounted for nearly one-third of all offenses attributed to hunters.

The usual high rate of convictions again prevailed during the biennium which found only 85 cases, or .36 of one percent of all arrests, culminating in 'not guilty' verdicts rendered by courts and juries. Dismissals reached a slightly higher figure with the courts dismissing 146 cases, many at the request of the arresting officer, for a percentage of .61 of one percent. The combined 'not guilty' and dismissed cases amounted to .97 of one percent, .03 of one percent higher than during the previous biennium.

NEW EQUIPMENT AND DUTIES

The Wildlife Protection Branch has been assigned the primary responsibility of checking water releases from dams and water diversions throughout the State. Licenses and permits issued to dam and diversion owners by the Federal Power Commission and the State Water Rights Board contain provisions requir-

A warden and fisheries men inspect a floating holding tank for silver salmon at Pudding Creek, Mendocino County. All construction at the station was performed by the Silver Salmon Committee of Fort Brogg in conjunction with the Mendocino County Fish and Game Committee.

—Fish and Game Photo

ing specific water releases to maintain fish life adequately in streams below these structures.

While many of these water projects are easily accessible and flows may be measured without difficulty, others are in remote areas and inspection requires considerable time and effort, particularly during the winter months. This function is considered extremely important to safeguard fish and wildlife habitat as more and more water projects are developed on previously untouched watersheds.

Wardens continue to regulate late-summer water releases from stream flow maintenance dams in the Sierras, but their tasks have been made easier in many instances by the installation of weir-board water measuring devices. With these accurate measuring facilities wardens are now able to insure the maximum beneficial use of stored water over the desired release period.

Radiation Detection

In co-operation with the statewide Civil Defense program, the Wildlife Protection Branch was assigned the responsibility of radiation fallout detection which would be required in the event of any atomic explosion. A number of wardens attended radiological detection meter operator schools, learning the proper use of detection instruments provided by Civil Defense. These devices, designed to measure the radioactive intensity of any fissionable materials fallout as would occur after an atomic bomb detonation, have been assigned to wardens throughout the State.

Civil Defense plans also call for the use of wardens to man the base radio stations which will gather fallout reading data from the mobile monitoring units.

Captains districts were readjusted during the early part of the biennium with the addition of six new captain positions. This increase in supervisory personnel resulted in a more desirable distribution of districts of reduced size, enabling the captains to have better working relationships with their wardens.

New Wardens

The warden complement was increased 13 percent in the early part of the biennium, when in October, 1956, 25 new men were assigned to the force.

Before taking over duties in their respective districts, these men attended a comprehensive and intensive two-week departmental training program held at Strawberry Lodge in El Dorado County. Indoctrination and orientation sessions were held, as well as classes covering patrol practices, court procedures, law interpretation, rules of evidence and arrest, and laws governing search and seizure. Experience has shown the lessons learned in these schools of instruction are invaluable to both the wardens and the department.

During their first year of employment, wardens received interbranch assignments which gave them the opportunity to participate in other functions, learning first-hand the duties and problems of their fellow employees in other branches.

Reserve Wardens

Units of reserve wardens contributed thousands of hours of their time and performed invaluable service in enforcement work during the biennium. Working with department wardens, the unpaid reserves enabled regular patrols to cover greater areas and resulted in a more thorough check of hunters and anglers.

In many areas where it was suspected that violations were occurring, reserve wardens were assigned to out-of-uniform patrol and surveillance, and succeeded in bringing a number of violators to justice.

These men also devoted many additional hours to the hunter safety training program, conducting classes for junior hunters and teaching them the proper use of firearms by practical instruction on rifle ranges.

With the addition of a new class of reserves in the San Francisco Bay area during the latter part of the biennium, the department now has a reserve force of approximately 277 men.

GENERAL TRAINING PROGRAM

Greater emphasis was placed upon training during the biennium and wildlife protection supervisors, in close co-operation with the department training officer and regional training co-ordinators, formulated basic training goals for newly appointed wardens and experienced wardens alike.

Wildlife protection men gathered frequently during the last two years, usually on a monthly schedule, to discuss topics of current interest relating to their work. Representatives of other department functions also attended these meetings, keeping the wardens informed of developments and progress of game and fish management programs, administration and personnel procedures.

While most of these one-day training sessions drew wardens from two or more captains' districts together, several regionwide meetings were also conducted. At these regional training classes representatives of other law enforcement agencies, including the FBI, Bureau of Narcotics Enforcement, California Highway Patrol, Attorney General's Office, and District Attorney Offices, appeared and discussed their law enforcement practices, court rulings on recent appeals, and proper methods of arrest and handling of prisoners.

Instruction in public relations and public speaking was also stressed at interbranch training meetings, aimed toward the effective presentation of department programs and policies to sportsmen's groups and civic organizations.

Wardens gained valuable information from these training meetings and the end of the biennium found our enforcement men better qualified to perform their varied daily duties than at any time in the past.

Wardens "questian" a suspect at a wardens training sessian in which field problems were augmented by lectures an variaus phases af law enforcement and by group discussians. Wardens are Matt Remezane, left, Ted Halladay (the suspect) and Jack Wilsan.

—Fish and Game Photo

Marksmanship Training Program

While informal pistol shoots among wardens have been held for many years, a pistol marksmanship training program was not initiated until the beginning of the biennium.

The uniform regulations specify that wardens shall equip themselves with a .38 caliber revolver. With the increase of population, more major crimes are being committed over a wider area than ever before. Wardens' vehicles are equipped with two-way radios and in many localities they have direct communication with the county sheriff's office. As a result, wardens are often called upon to assist other law enforcement agencies in the apprehension of persons who had committed felonious crimes. The department believes that if its enforcement personnel have occasion to enter a dangerous situation, knowingly or in the normal course of checking armed hunters or apprehending armed game law violators, the wardens should then have adequate pistol training to defend themselves properly and take command of a situation if attacked.

In the first year of the program, 100 rounds of .38 caliber ammunition were purchased for each member of the force. Prior to this time pistol practice shoots were held irregularly with wardens furnishing their own ammunition. Early in the 1957-58 Fiscal Year, the ammunition allotment was increased to 300 rounds per man, with the requirement that at least six 30-round Camp Perry type course scores be fired during the year. Wardens were encouraged to use the remaining ammunition for additional target practice at their convenience.

Wardens participated in open competition pistol matches during the biennium in order to obtain additional desirable techniques to be incorporated into this training program.

POLLUTION DETECTION

All regions found public interest and opinions changing, for the better, toward the increasing problem of pollution of both ocean waters and inland streams. Some industrial operations are now cleaning up long-standing pollution situations at considerable expense.

In the San Francisco and Los Angeles areas, where industrial pollution is a major concern, wardens were assigned to pollution enforcement and prevention details, with such work comprising their primary duty. These wardens have attended Regional Water Pollution Control Board meetings and hearings and have presented the department's recommendations, in co-operation with fisheries personnel, on pollution problems and waste discharge quality requirements.

The Fresno area (Region 4) has completed a comprehensive survey of all present and possible future sources of pollution throughout its region, and has drawn plans to cope with many unsatisfactory conditions.

The Redding (Region 1) and Sacramento (Region 2) areas, not without industrial waste discharge problems, are also concentrating on log jams and stream obstructions caused by improper logging practices. Close co-operation with the State Division of Forestry was experienced during the biennium and state agencies are now presenting a united front respecting stream cleanup. Loggers have shown a marked interest and co-operative spirit in reopening streams closed to migrating fish by log jams or decaying timber refuse. Spawning runs of salmon, steelhead and trout are now able to utilize many more miles of suitable streams because the general public and loggers realize that streams free of obstructions are necessary to perpetuate these species.

Disposal of radioactive wastes increased greatly during the past two years as industry found a multitude of uses for radioactive materials. Investigations were instituted and are continuing on the present so-called "safe" methods of "hot waste" disposal and the effects upon fish life, particularly in ocean waters. As it is entirely possible that the disposal of these waste products will be the greatest problem confronting the department in the immediate future, every effort was made to get in on the ground floor by keeping abreast of disposal techniques, laying groundwork for future monitoring of all possible sources of contamination and gathering evidence for recommending safer disposal methods.

Wardens in all regions received training in pollution enforcement procedures in this all-out effort to preserve present high-quality waters in the state and to improve the quality of waters now polluted and unsuitable for fish life.

AIR PATROL

Law enforcement activities were assisted and made more effective by use of the department's aircraft, particularly the two light Cessnas. Operating out of the Sacramento airport, the Cessna 180 was used in the northern half of the state in co-ordinated air-land patrols. During the fall salmon runs, air patrol provided rapid, effective coverage of spawning beds on many miles of salmon streams and resulted in numerous arrests of violators taking fish in closed areas and by unlawful methods. With a warden-pilot observer aloft to direct ground forces, this salmon patrol technique has proven highly successful and has undoubtedly saved hundreds of spawning fish.

Stationed at San Bernardino, the Cessna 170 is used for patrol in the southern part of California, particularly to check activity in remote desert areas where access by motor vehicle is time-consuming and difficult.

Both planes are used to locate isolated hunting and fishing camps immediately prior to fishing or hunting season openings, for often these early, remote camps are sources of various violations.

New wardens, or wardens assigned to a new district, utilize the aircraft to familiarize themselves with the overall terrain of their jurisdiction. Many wardens, having been in an area several years, find aerial observation invaluable in locating new access roads, camps and other minute details not readily observed from the ground.

Shortly before the opening of the 1958 commercial salmon season, news releases reported the Wildlife Protection Branch intended to establish an aerial patrol of northern ocean waters to prevent fishermen from "jumping the gun." The subsequent offshore patrol by the twin-engine Beechcraft indicated the effectiveness of the warning, for although many boats were on the fishing grounds early, none were engaged in the preseason fishing activity which was reported to have prevailed during previous years.

Use of the airplanes by wildlife protection personnel was restricted by demands upon the aircraft by other functions. During the 1956-57 Fiscal Year, 30.26 percent of the total hours flown by the Cessna 180 was for patrol activities. For the period 1957-58 the percentage dropped to 28.6.

During 1956-57, 32 percent of the flight time for the Cessna 170 was for patrol, increasing to 35.2 in 1957-58.

The twin-engine Beechcraft, less adapted to patrol activities, charged only 5.04 percent of its flight time to wildlife protection in the first half of the biennium and 8.3 percent during the second half.

Game Management

Two Sacramento Valley hunters just a breath away from bagging a couple of pheasants.

—Photo by Birdie Boyles

The most important development in game management services during the biennium was the reorganization of the regional game functions into 34 game management units. This form or organization was put into effect after detailed studies on ways and means of improving wildlife management practices and providing services to the sportsmen of the State.

Under this system, a man (Game Manager I grade) is assigned to each of the 34 units. He is the unit manager and within his unit he is in charge of all game management activities except those in major installations. This style of operation has been a great improvement in game management activities, resulting in a clarification of duties, elimination of overlapping effort, improved public contact, and collection of more basic field data on game species.

Work of the unit managers is directed toward creating the greatest amount of hunting recreation consistent with sound game management practices. A great potential exists along this line.

The unit management system is designed to bring about more efficient game management through improved methods of gathering field management data.

The steady increase in the state's population is creating mounting demands in the recreational field, of which hunting is a part. Only through using the resource up to the potential can the state keep pace with the needs of the public for hunting recreation.

Under the U. S. Co-ordination Act of 1946, the department has requested administrative use of 553,572 acres of public lands. The proposal is to keep these lands in the public domain to insure their continued use for wildlife and recreational purposes. (See Table 54 Appendix.) Plans call for habitat development and construction of access on these lands as funds become available.

The present status of these withdrawals is in the hands of the Federal Government. A decision on when and how many of these withdrawals will be completed had not been rendered at the end of the biennium.

The waterfowl program continues to be an outstanding example of successful game management. Co-operation with the Bureau of Sport Fisheries and Wildlife through the Pacific Flyway Council has given California hunters a maximum bag limit and length of season. It is a prime example of what can be done through interagency co-operation based on adequate data gathered through scientific investigations.

Mule deer with trophy rock.
—Fish and Game Photo

FEDERAL AID

Apportionments of federal aid money during the biennium amounted to $1,587,506. California's contribution, as required by the Pittman-Robertson Act, was $529,169, making a total of $2,116,675 available for carrying out the federal aid program in California.

Federal aid apportionments were the highest since the state entered the program in 1940, exceeding the amount received during the preceding biennium by $441,235.

The increase was due to two factors: first, there has been a steady rise in federal receipts derived from the excise tax on arms and ammunition; second was the addition of the Bible Bill funds. Under the Bible Bill, certain accumulated Pittman-Robertson moneys over a five-year period were released to the states. For the biennium for California this amounted to more than $200,000.

The increase in funds came at just the right time. The development and operation of waterfowl areas, recently acquired by Wildlife Conservation Board Funds, at Wister, Mendota and Gray Lodge produced added expense. During the biennium, a number of positions, together with certain operational expenses on the waterfowl areas formerly supported by license revenue, were transferred to the federal aid program. Moreover the general rise in costs has taken its share of dollars.

The department's Pittman-Robertson program is divided into 14 projects. Five of these projects are devoted to investigations and management. They are by nature research and fact-finding projects and are the bases for determining what is necessary for the management of game species. Approximately 37 percent of the funds were expended in this category. Six projects are concerned with the development and maintenance of waterfowl management areas. Forty-three percent of the funds go here. Two projects are concerned with game habitat development and take 17 percent of the funds. A single project co-ordinates the program and this takes 3 percent.

DEER

Deer hunters had good hunting during the biennium although not up to the all-time record bags made during the previous two years. The buck kill in 1956 was 70,371 and in 1957, 65,214. This compares with the record bag of 75,602 in 1954. Actually the third and fourth best kills on record were made during the biennium.

The state's deer herds are at high levels, probably as high as at any time in history. Survival of deer over the past two mild winters has been exceptional.

General Either-Sex Deer Hunt

California held its first general either-sex deer season in 1956. The area opened to either-sex hunting consisted of 34 of the state's 58 counties. All hunters who possessed a "B" deer tag were allowed to use it for taking one deer of either sex during the last three days of both the coastal and inland seasons.

At the time the either-sex season was authorized by the California Fish and Game Commission, there was considerable public support for the hunts. It was felt that a definite step forward in the management of the state's deer herds had been made. As the actual time for the season approached, public opposition to the hunt had begun to develop. After the season, a veritable storm of opposition developed and was reflected in numerous proposals for legislation concerning deer management in the 1957 legislative session. Out of this controversy, the Busch Bill was passed and is now the basis for regulating the deer harvest.

At this time a more sober appraisal of the results of this first general either-sex deer hunt can be made than was possible right after the season.

There is no evidence to indicate that any deer herds were shot down to the point of endangering the breeding stocks. Herd counts and kill figures in the year subsequent to the hunt remained high.

In the coastal season the area opened to either-sex hunting produced a kill of 14,151 legal bucks and 5,747 antlerless deer. In the inland area, 30,423 legal bucks and 32,334 antlerless deer were bagged. It is estimated that in the coastal area open to either-sex hunting, 9.5 percent of the deer population had been taken; in the

These three pictures taken on the winter deer range at Lions Point, San Joaquin County, show treatment, production and utilization of browse and grass by deer. Upper picture shows a heavy stand of wedgeleaf ceanothus as it appeared after mashing with a bulldozer. This area was burned in November, 1955. Center picture shows the same area as it appeared in October, 1957. Yerba santa seedlings dominate the scene but large numbers of wedgeleaf ceonothus seedlings are present. Production for the 1957 season was 1,000 pounds of browse per acre, compared to less than 100 pounds per acre prior to treatment. Lower picture was taken in April, 1958. Deer had utilized 60 percent of the growth on the yerba santa seedlings.

—Fish and Game Photos

inland area 18.5 percent was taken. Since experience in other states has shown that 25 to 30 percent of a deer herd can safely be harvested on a yearly basis, California's kill was well within safe limits.

One serious management problem did develop during the experimental either-sex hunt—the problem of hunter distribution. Hunters concentrated in dangerous levels in certain favorite hunting spots notably in parts of Los Angeles County, at the Tehama winter deer range, at Doyle, Lassen County, and at the Devil's Garden in Modoc County. Even here the problem was one of hunter safety, rather than danger of overshooting the deer herds.

In appraising the effect of this first general either-sex season, it can be said that general either-sex seasons are good management, especially in coast range agricultural areas. In the balance of the state, unit-quota hunts are indicated for the reason of safety to life and property.

Special Deer Hunts

Seventeen controlled deer hunts were held during the biennium, authorized by the Fish and Game Commission for the purpose of controlling deer depredations on crop lands or for the purpose of relieving pressure on the deer ranges. These hunts were authorized only if the local people involved gave their support to the hunts.

Wherever these hunts have been held, they have made a contribution to good deer management.

The permit quota for these hunts was 10,525. Permits sold amounted to 9,670. The permittees bagged a total of 5,376 deer (see Table 52).

Investigations

Investigations regarding California's deer herds during the biennium were concerned mainly with trapping and marking to determine herd migration patterns and in gathering routine management data such as range conditions, various herd censuses, and herd composition counts.

Investigations are continuing on brush manipulation methods and browse restoration techniques.

Trapping and Marking

Deer have been trapped, marked and released in several areas throughout the state in order to fill in gaps in knowledge of herd movements. Some of the marking devices were bells, ear tags and colored collars.

The areas of greatest trapping activity were the Peterson Mountain winter range of eastern Lassen County, where 211 deer were marked; San Joaquin winter range, 151; Kern River winter range, 72; and eastern Siskiyou County summer ranges, approximately 50.

Brush Removal Studies

The brush removal study is a segment of the federal aid big game investigation, under a contract agreement with the University of California. Studying the effect of mashing and burning brush on the San Joaquin winter deer range has received major emphasis for the last two years. Spring burning has been found to benefit forage production of root-sprouting species

Pronghorn antelope in northeastern California.
—Fish and Game Photo

best. Fall burning is indicated as most beneficial in establishing seedlings of nonsprouting species. Either treatment greatly increases forage production from the level existing in mature, unmanaged brush.

Browse Restoration Studies

The browse restoration study is a segment of the big game investigations project, under contract with the California Forest and Range Experiment Station. Considerable progress in understanding the conditions necessary for bitterbrush establishment and this knowledge has been applied to several trial plantings during the last two years. An 18-acre planting at Flukey Well, Modoc County, is receiving intensive follow-up study.

Several other browse species of importance to deer are being studied. Of these, four-wing saltbush shows the greatest promise to date. It is palatable to deer and is a fast-growing species.

Busch Bill

Legislation of major importance to deer management, the "Busch Bill," became effective in 1957. Under this law, deer are to be managed on a herd basis. Accordingly, the department has divided the state into 114 deer herd subunits. The first annual report on conditions in each subunit, and recommendations for antlerless or either-sex hunts, was made to the commission in May of 1958 in accordance with the provisions of the legislation.

ELK

The annual midwinter aerial census of the Owens Valley tule elk herd resulted in a count of 174 elk (33 bulls, 141 cows) in February, 1957, and 225 (63 bulls, 162 cows) in January, 1958. The plan of management states that whenever the census shows a population in excess of 275, a hunt will be held to reduce the population to about 125 head. It is believed that close adherence to this plan will result in keeping agricultural conflicts at a tolerable level and maintaining a healthy and productive elk herd in balance with its range.

It is estimated that there are about 1,000 Roosevelt elk in Humboldt and Del Norte Counties, about 80 transplanted tule elk in Lake and Colusa Counties, and about 250 transplanted Rocky Mountain elk in Shasta, Monterey and San Diego Counties.

The statewide population is estimated to be about 1,500.

ANTELOPE

The annual midwinter aerial antelope censuses in northeastern California tallied 2,080 in January, 1957, and 2,165 in January, 1958. The 1958 figure is exactly the same as the previous five-year average. This shows that the population has been relatively stable at about 2,100 antelope for this period. Since some animals are always missed, the actual population is somewhat higher. An additional estimated 180 animals are present in Mono County.

The annual midsummer aerial band composition counts in northeastern California showed ratios of 55 bucks to 100 does to 66 kids in July, 1957, and 58 bucks: 100 does: 70 kids in 1958.

Range conditions are poor on much of the antelope range. The band composition counts show a surplus of bucks. Harvesting of the excess males would benefit the remainder of the herd, as well as provide trophy hunting.

QUAIL

Quail hunting was fair to good during the biennium. The 1957 reported bag of 1,648,800 was above average for recent years (Table 47).

Water developments, guzzlers and springs, in the desert areas were instrumental in keeping populations going during the dry years prior to this spring. Excellent rainfall last season created extremely favorable upland game conditions on the desert in the spring of 1958. As a result, local quail populations have increased and spread throughout the southern part of the state to where the 1958 fall hunting should have been the best in recent years.

Investigations

Department personnel trapped and banded 1,231 quail in the Panoche and Jacalitos areas west of the San Joaquin Valley. Returns from these bands indicated 23 percent of the population was harvested by hunters in the Panoche area and 14 percent in the Jacalitos area. These check areas are in some of the most heavily hunted quail country. Since a safe harvest of quail is about 25 percent, it is readily seen that more quail can safely be taken.

Statewide, quail are capable of producing much more hunting recreation than is taking place at the present time. The sportsmen are not using this resource to anywhere near its reproductive capabilities.

Chukar partridge.
—Fish and Game Photo

CHUKAR PARTRIDGES

California's first open season on chukars occurred in 1954 with a four-day season. The average yearly reported bag through 1957 was 4,300 birds. Considering the numbers of birds available in the field, the hunters are hardly touching the resource. Because of this, the open season has been lengthened so that in 1957 the season extended from November 16 to December 31, 1957.

It has been known for some time that the species had established itself in goodly numbers in most suitable habitat throughout the state. After four successive hunting seasons, it is obvious that chukars can readily withstand hunting pressure. It can now be concluded that the introduction of this bird into California fauna was a success.

The department is continuing to try to expand the present range of the species. There are still some areas which appear suitable that have not had sufficient plants of birds. Planting of these areas is progressing with wild-trapped chukars. One of the latest successful plants was made at Panoche. This area was planted with wild birds trapped from the Naval Ordnance Test Station at China Lake.

GROUSE

Sage grouse seasons (September 1-2) were held in Modoc and Lassen Counties during the biennium. The average bag has been 2,700 for the past four years according to returns from mail questionnaires. Sage grouse occur in other eastside counties but populations have been too low to allow an open season. Production in the spring of 1958 indicated increased populations of these birds in the northeast counties.

During the fall of 1957 an open season on Sierra and ruffed grouse was held for the first time in many years. Field reports indicated few hunters were out for the birds and a small kill resulted (see Table 47).

EXOTICS

The department has recognized the increasing interest and demands for the introduction of foreign game species into the state. Because of this, it is looking into the problem of game-deficient habitats and is endeavoring to determine what species offer the most promise of success in introduction.

There are a variety of habitats that are little used by game birds at present. Among these are the drier desert areas, the open sagebrush plains, the middle and high altitude timbered mountain regions and the low foothill areas surrounding the great valley.

Preliminary studies indicate that some of the birds of the genus Alectoris, related to the Indian chukar may offer possibilities. Among these are the Barbary partridge, the Spanish red-legged partridge and Greek and Turkish chukars.

In early February of 1958, an initial plant of 152 Barbary partridges was made in the foothills of the southern Sierra near Lindsay. These were purchased from a private breeder.

Preliminary negotiations are under way for securing a stock of Spanish red-legged partridges and Turkish and Greek chukars. It is hoped these will fill in areas where the Indian chukars have failed to establish themselves.

The past two years have seen a number of plants of Coturnix quail and Erkels francolins by private sportsmen and breeders. It is estimated that more than 9,000 Coturnix quail have been released in the Sacramento Valley the past two years. The result of these plants is yet to be determined.

Permits Now Necessary

Private breeders now are required to secure permission from the commission before plants of exotics are made. This will enable the department to keep track of all introductions, and data as to the success or failures can be obtained. In this way, plantings of birds that may be hazardous to California agriculture and native wildlife may be prevented.

A word of caution should be inserted regarding introduction of exotics. Enthusiasm for such a program often runs high. The odds are against successes such as were obtained in the introduction of the ring-necked pheasant and the Indian chukar.

WATERFOWL

Year after year, ducks produce the greatest total bag of any species of game hunted and the past biennium was no exception. Waterfowl hunters continue to enjoy excellent sport.

Mail surveys revealed (Table 47) that the 4,025,000 ducks taken during the 1957 season was the best bag reported during the last four years. The 1956 season produced a bag close to the average for the last four years.

Hunter and dog getting set for the next flight of birds on the Napa marshes.

—Fish and Game Photo.

The goose bag is holding up very well. During the 1957 season, 366,900 geese were reported from the mail survey. This is slightly below the four-year average of 369,300.

Mail surveys reveal a surprising amount of coots bagged. During the biennium, coots taken exceeded the numbers of geese bagged.

WATERFOWL MANAGEMENT AREAS

State waterfowl management areas now total 53,854.45 acres (Table 55), of which 47,237.55 acres are owned and 6,616.90 acres are leased. Since the acquisition and development of these areas, waterfowl depredations on agricultural lands is no longer a serious problem. The feed and water available on these lands give the birds living space during the critical early fall depredation period when it is most needed.

Not the least of the benefits derived from these areas is the hunting recreation provided. During the biennium a record number of hunters made a record bag of waterfowl (Table 49). State-owned and state-operated federal areas produced 104,641 man days of hunting and a bag of 314,862 birds.

At Honey Lake and Grizzly Island, development is virtually complete with activities confined to waterfowl food crop production and general maintenance.

During the preceding biennium, additional areas were purchased with Wildlife Conservation Board funds at Gray Lodge, Mendota and Imperial. Development of these acquisitions is proceeding according to plan.

Water control structures, pumps and ditches were under construction at Mendota. These are financed by Grasslands funds. Pumps, wells and ditches were under construction at Gray Lodge to develop some 4,000 acres of crop and ponded areas. Financing is by Wildlife Board funds.

Upon the recommendations of the department, the Madeline Plains Waterfowl Area was declared surplus property by the 1957 Legislature. Disposal of this land is now under way by the Lands Acquisition Division of the Department of Finance. Madeline Plains had failed to come up to expectations. A rigorous climate and lack of adequate water supplies doomed its development into an efficient management area.

Winter Inventories

Field studies have shown that waterfowl populations have been at high levels during the biennium. Winter inventories are conducted yearly during January. This is a joint effort with the U. S. Bureau of Sport Fisheries and Wildlife. Six airplanes and a helicopter have been used to cover the state. The refuges and other large concentrations of birds are photographed. Smaller pockets of birds are estimated.

In January of 1957 a total of 3,800,000 ducks were tallied; in 1958 the total was 5,370,000. The 1958 total was the highest ever recorded during a winter inventory since current census methods were instituted in

1951. The results of these surveys are indicative of the number of birds that will return to the breeding grounds.

Breeding Grounds Surveys

Along with similar surveys in other states, Canada and Alaska, breeding grounds surveys are used in determining annual hunting regulations. While most of the waterfowl produced on the Pacific Flyway come from Canada and Alaska, a sizable number are produced in California. Mallard ducks and Canada geese are the principal California breeders.

In the spring of 1957, 240,460 young and old ducks, and 19,280 Canada geese were tallied on local breeding areas. In 1958, 264,980 ducks and 25,190 Canada geese were tallied. Conditions on the breeding grounds were unusually favorable during the spring of 1958 due to abundant water supplies.

Marsh Management Studies

A new phase of investigation, the marsh management studies, got under way during the biennium. The goal is to determine the most efficient methods of developing waterfowl habitat, both government-owned and private.

The study includes devising techniques for planting various types of aquatic plants, effects of water levels and soil conditions on habitat, and methods of controlling marsh "weeds," such as cattails and tules. Experimental plantings of watergrass, alkali bulrush and spikerush have been made on waterfowl management areas and co-operating private duck clubs.

As a result of experimentation on various state waterfowl management areas, there have been some definite improvements in waterfowl habitat. The increased use of watergrass (millet) as a food plant has made possible production of abundant waterfowl food more cheaply than was possible by using straight cereal crops. Watergrass has the added advantage of producing abundantly by volunteering. The Los Banos area, especially, has been considerably improved by watergrass.

Massed flight at Gray Lodge.
Fish and Game Photo by Wm. Anderson

Hunters with limits on opening day at the Moreno Lakeside Pheasant Co-op, San Diego County.
—Fish and Game Photo

Banding Program

During the past two years, the waterfowl project banded 56,940 ducks, 10,121 geese, and 6,287 coots. Returns from these bands are used to determine mortality rates, population turnover and migration patterns. All are vital to intelligent management of the resource.

PHEASANTS

The biennium produced better than average hunting for pheasants. Questionnaire data showed 613,800 cocks bagged in 1956 and 630,500 in 1957. The average for the past four years was 587,300. The period saw the second and third years of hen shooting. This produced more than 100,000 additional birds yearly to the bag (Table 47).

Investigations during the period were concerned primarily with assessing the effects of hen shooting in the better pheasant habitat areas of the Sacramento Valley. There is no evidence to indicate that allowing one hen in the seasonal bag was in any way harmful to the pheasant populations.

Pheasant numbers have fully recovered in the Yuba City district which was flooded in December, 1955. Here, hen shooting did not impair the recovery of the birds.

Game Farms

The biennium saw some definite improvement in efficiency in game farm production. The Los Banos and Porterville game farms were closed and their production assumed by the Fresno farm. The Castaic in-

Nesting mourning dove.
—Fish and Game Photo

stallation was closed and production transferred to Los Seranos at Chino. These moves had the effect of reducing costs by cutting down manpower needs and reducing other expenses.

Production of game farm pheasants has been stabilized at around 75,000 birds per year—50,000 of them raised by the state and the balance by sportsmen's organizations. The liberation of these birds by county is shown in Table 51.

Co-operative Hunting

California's co-op pheasant hunting program peaked in 1954 when nearly 190,000 acres were available to the sportsmen. Since then there has been a steady reduction in the amount of land included in the program to 96,000 acres in 1957 (Table 50).

The reasons for the decline of the co-op program are involved in economics. The good pheasant areas in California are limited and competition for pheasant hunting lands between the state, private individuals and community organizations is keen.

Virtually all pheasant hunting is to be found on private lands, state and federal waterfowl management areas being the only exceptions. Landowners are becoming aware of the possibilities of supplementing their income through the sale of hunting privileges. As a result, there has been a steady increase in licensed pheasant clubs. In 1957, there were 91 "Zone A" clubs totaling 85,537 acres. These clubs are located in the better pheasant habitat. The club pays the landowners for the shooting rights. An idea as to the value of these hunting privileges can be gleaned from the report that one club paid a landowner $5,000 for a single season's hunting on 500 acres.

The growth of community hunting areas is another factor in the pheasant hunting picture. The community areas secure lands and sell hunting privileges as money-raising activities for various community projects. In 1957, there were 12 of these projects which involved 269,000 acres of land. Membership in these clubs run from $6 to $10 per season per adult hunter.

The trend to more licensed pheasant clubs and community areas is showing no signs of abating.

Hunting on Waterfowl Areas

Hunting on state and federal areas in 1957 produced 9,975 man-days of hunting for a bag of 4,053 birds (Table 49). The Gray Lodge unit produced exceptional hunting.

DOVES

Dove populations throughout the state have been at a high level in the last two years and hunters have enjoyed excellent sport.

Mail questionnaire results placed the bag at 3,233,900 birds in 1957, the highest reported take of doves since regular mail questionnaires were initiated in 1948. The 1956 bag was also above average (Table 49).

The department's upland game study project has been concerned during the last two years mainly with gathering data on doves. Probably the most significant result of the study to date has been derived from the banding program. During the biennium, 7,061 doves were banded. The bands were placed on nestlings and wild trapped birds. Only about 3.5 percent of the bands have been recovered. This is a very low rate of return and certainly indicates that the hunter take is low, compared to the total population of the species. As a comparison, first year band returns from waterfowl run commonly from 12 to 18 percent.

Banding studies have shown that both resident and migratory populations of doves exist. The migratory birds sometimes cover considerable distances, a few example of which are listed below.

Area Banded	*Date*	*Area of Return*	*Date*
Fort Rock, Lake Co., Oregon	8/21/57	Indio, Riverside Co., California	9/12/57
Edinburg, Texas	4/14/55	Winton, Merced Co., California	9/ 1/57
Wenatchee, Washington	7/15/57	Verona, Sutter Co., California	9/ 1/57
Coso Mtns., Inyo Co., California	8/24/56	Green River, Utah	9/ 6/57
Mather, Sacramento Co., California	8/ 3/57	Aguililla, Michoacán, Mexico	12/ 8/57

Numerous other phases of dove life history are under study, including determining migration patterns, nesting studies and food habits.

Protectionist Activities

In 1957, the Legislature was asked to place the dove on the songbird list and the proposal was passed on to the Assembly Fish and Game Committee for study.

Sportsmen opposed the proposal and presented its case for continuing the dove as a game bird. The dove produces the greatest bag in point of numbers of any species of game. It is exceeded only by the combined bag of all species of ducks. Of the bird species, only pheasants and waterfowl are sought after by more individual hunters. More people hunt doves than hunt quail.

In the southern part of the state where hunting opportunities are most needed the dove is the leading game bird species. From the standpoint of the welfare of the species, hunters take only a small portion of the total population. It is unlikely that if all dove hunting were stopped that a significant rise in the population would take place.

HABITAT IMPROVEMENT

A variety of habitat improvement activities was carried out during the biennium with federal aid funds.

More than 2,000 artificial watering devices (guzzlers) for the benefit of upland game are now in operation. Maintenance work was performed on these installations. Seventeen new guzzlers were installed, including one 10,000-gallon unit in Riverside County for use of mountain sheep. Four sumps were constructed for deer watering sites in the Redding (Region 1) area.

Dove, showing wing primary feathers.
—Fish and Game Photo

Forty-one new springs were developed, mainly in desert areas, and 151 others were inspected and maintained. This work consists mainly of creating rock basins, cleaning out silt and controlling excessive vegetation at spring sites.

Hunter Access Roads

Seven miles of hunter access roads were constructed. In addition, the department supervised the construc-

Game managers Bob Weed, left, and Walton Smith, center, check the bag of an unidentified dove hunter as part of a program to determine the age and number of birds being taken. Inset shows development of primary wing feathers which help tell dove's age.
—Fish and Game Photo

Treed mountain lion.
—Fish and Game Photo

tion of 7½ miles of access road at King's Peak, Humboldt County, which was financed by county fine moneys. Twenty-two miles of previously constructed access roads were maintained.

Approximately 1,350 acres of brush was control burned in small plots. In addition, department personnel have actively participated in control burns initiated by the U. S. Forest Service.

Plantings of shrubs and trees for benefiting game totaled 4,821. Seven hundred fifty acres of burned areas were seeded to herbaceous plants. Other miscellaneous activities consisted of upland game brush pile construction and collection of seeds for planting deficient areas.

Considerable effort was expended in surveying the pending land withdrawal areas for future habitat development work and access road sites.

PREDATOR CONTROL

Mountain lions bountied during the biennium totaled 330. Of these, 86 were bountied by the three state lion hunters and 244 by private individuals. The bounty is $50 per male and $60 per female lion.

The department's predator control program was reduced during the biennium. There are no longer any employees whose full time is devoted to trapping predators.

Predator control now is strictly tied in with specific game management programs. For instance, predators are reduced on waterfowl management areas just prior to the nesting season. On these areas local management personnel trap predators as part of regular assigned duties.

The old system of using full-time trappers was not producing sufficient game management benefits relative to the expenses incurred.

FUR RESOURCES

The number of licensed trappers and amount of fur taken is influenced by economic conditions more than the natural supply of animals at the present time. During the biennium, fur prices were low, except for mink, otter and beaver. The muskrat, which furnishes the bulk of the fur taken in this state, was priced under one dollar per average raw pelt. As a result, fur trapping reached its lowest point in recent years.

During 1956-57 trapping season, the best of the two-year periods, 858 licensed trappers took 85,252 pelts with an estimated value of $96,000.

Fur buyer demand has been for the short-haired luxury type furs such as mink and otter. Buyers were taking muskrat, but at a low price. Such common furbearers as raccoons, coyotes, bobcats and skunks were practically unsalable.

WILDLIFE INVESTIGATIONS LABORATORY

The laboratory staff continued its investigations on the broad front of disease, food habits, nutritional and physiological studies, and on economic poisons as they are related to the welfare of wildlife.

Botulism

Several outbreaks of this condition occurred during the biennial period. One of the more serious situations was the continued mortality of waterfowl in

the Colusa National Wildlife Area. Losses were limited by the adoption of a suggestion made by personnel of the laboratory that continual hunting over the toxic area be used to keep the waterfowl out.

After intensive pilot studies, a large field trial involving over 10,000 birds was used to determine the effectiveness of toxoid vaccination of pheasants to limit losses due to botulism on a game farm. Birds inoculated with toxoid suffered a mortality of one-fifth of that experienced by uninoculated pheasants.

Trichomoniasis

Ten tons of medicated grain was distributed throughout the San Diego area in an effort to combat mourning dove losses attributable to this disease. Although a high degree of success was achieved by this effort, complete effectiveness was not realized inasmuch as not all foci of infection can be found and treated. This work evolved into a co-operative effort on the part of the people of San Diego who feed doves and the department personnel responsible for controlling disease in wildlife. The present approach has been the gradual decrease in the amount of feed put out by the dove feeders so as to avoid large concentrations of birds, thereby limiting the spread of the contagion.

Anaplasmosis

In co-operation with the School of Veterinary Medicine of the University of California at Davis, a study of anaplasmosis was initiated. The work was under-

Game parasitologist Mert Rasen studies a disease problem.

—Fish and Game Photo

taken to determine the relation between deer and cattle concerning this disease.

Working together, personnel of the two agencies completed the study and established the following facts: (1) deer can have a clinical infection of anaplasmosis; (2) they may retain infective blood for a year; (3) the standard test for bovine carriers (a complement fixation test), will not detect carrier deer three or four months after they have contracted the organism.

Services

Diagnostic services were performed for state game farms and other projects of the Game Management Branch, as well as for personnel on National Wildlife Refuges. Corrective or therapeutic measures were recommended for the control of losses in wildlife.

Blood tests and other standard laboratory procedures have been set up and used to detect the presence of disease in imported exotic game birds, both on the department's game farms and on private game farms. Quarantine procedures have been adopted to protect the wildlife of the state from the introduction of exotic disease. The full co-operation of the State Department of Agriculture Pathology Laboratory has been received in testing the blood specimens submitted from the above sources.

NUTRITION SECTION

A detailed study of the microclimate (subclimates) on the Doyle deer range has been carried out. Trapping and belling of deer and observations of their behavior and distribution with respect to weather conditions has given valuable information which may lead to a better understanding of the factors responsible for the changes in welfare and numbers of the deer herds.

Information gained in the field on this climate study is being evaluated in the light of certain laboratory experiments on seasonal variations in feed intake, measured in deer feeding trials and in field collections.

Evidence at this point is indisputable that feed intake varies seasonally, independent of the quality or quantity of feed present. A particularly low point in food consumption occurs in late winter at a time that the animals probably have very high growth and energy requirements.

Construction of a chamber providing a controlled environment for deer is essentially completed. With this device it is hoped that the factors contributing to the decline of deer numbers or condition may be objectively evaluated, particularly with regard to the influence of fluctuating daily temperatures, daily mean temperatures, day length and internal rhythms as they affect feed consumption.

ECONOMIC POISONS SECTION

Close liaison with agencies and individuals using pesticides resulted in the accumulation of practical data regarding pesticide uses and regulations in California. This data was presented in lecture form to most of the game management and wildlife protection personnel.

Field investigations on incidence of wildlife losses and requests by field personnel resulted in studies on the effects and toxicity of certain rodenticides, insecticides and fungicides on game species. These studies provided basic information necessary in determining causes of poisonings. They also provided background data for making recommendations to agencies handling and applying toxic chemicals that are intended to minimize hazards to wildlife.

The immediate effects of pesticides are usually apparent, but a great deal of work is needed to determine the inevitable long range results of continued pesticide applications. This can best be accomplished by studies that actually determine the ultimate effects on wildlife populations of continued applications of toxic chemicals. Any adverse findings would require convincing manufacturers and users of the need for pesticides of more specific action and greater control, and understanding of methods of application.

FOOD HABITS SECTION

During the biennium the food habits studies of game and predator species was continued. A concentrated effort was made on waterfowl and mourning doves. Knowledge of their food preferences becomes a valuable tool for managing habitat in their favor.

PUBLICATIONS

Two publications on technical studies were released during the biennium in the form of Game Bulletins Nos. 7 and 8.

Game Bulletin No. 7, entitled "Pesticides: Their Use and Toxicity in Relation to Wildlife," was written by Robert L. Rudd and Richard E. Genelly. This bulletin reported on the results of the department's Federal Aid Project W-45-R "Effects of Economic Poisons on Wildlife." It has received nationwide recognition as the best publication available on the subject of pesticides and their effects on wildlife.

Game Bulletin No. 8, entitled "The Black-Tailed Deer of the Chaparral," was written by Richard D. Taber and Raymond F. Dasmann. It is a report on north coast deer range deer and their management. The work on which this bulletin was based was done under contract with the University of California as part of the department's federal aid study on brush manipulation problems.

Water Projects

Water diverted from Friant Dam, background, has left salmon high and dry during spawning runs up the San Joaquin River. The department was seeking water for salmon at a State Water Rights Board hearing which began at the end of the biennium.

—Bureau of Reclamation Photo

Through the years the people of California have been quick to obtain legislation to prevent overharvesting, or other direct damage, to the publicly owned fish and game resources. Unfortunately, *the absolute necessity* of maintaining a suitable habitat for these resources has not always been so readily recognized.

Water is a key element in the habitat of our fish and game resources, and without proper amounts and quality of water they will be destroyed. Thus, the maintenance of these resources is inextricably tied to water supplies, and water development projects can have major effects on our fish and wildlife resources.

Dams create barriers to migratory species of fish, preventing access to their ancestral spawning grounds. Diversion of water in excessive amounts can leave the stream without sufficient water to provide for fish food production, spawning, migrations, etc. The fish may not be killed immediately, but the population gradually declines and the end result is the same. The water needs of waterfowl can be impaired and migration routes of game animals can be disrupted. These are some of the more obvious adverse effects, although there are many others.

On the other hand, a water project can result in improved water supplies or water quality for fish and wildlife. In some cases they have provided better conditions than existed prior to the development. Creation of other types of water-associated recreation, and improved access to recreation areas are other beneficial effects of some projects.

The prevention of damage to the fish and wildlife resources involves the maintenance of adequate stream flows, construction of fish ladders, fish screens, fish hatcheries, project facility changes and many other special provisions, all of which are costly and sometimes have a major effect on the economics or feasibility of a project.

Enhancement Opportunities

In most water development projects there are excellent opportunities for enhancement of fish and game, and if advantage is taken of these opportunities, through multipurpose long-range planning, it will have a major effect on the economic strength of the state in the future.

The Department of Fish and Game is the state agency charged with protecting and maintaining the public resources of fish and wildlife. In carrying out these responsibilities the department is guided by legislation and Fish and Game Commission policies, all of which cause the department to become involved in the review of proposed water project developments to analyze and evaluate their adverse and beneficial effects on fish and wildlife resources.

Federal legislation has recognized the importance of fish and wildlife and has provided specific mechanics for the evaluation of the effects on fish and game resources of federal water developments and other water projects coming under federal permit. Under the provision of this law the department reviews all Bureau of Reclamation and Corps of Engineers projects and applications for Federal Power Commission licenses, and it has been able to prevent many of the kinds of losses to fish and wildlife that frequently occurred in single purpose water development projects prior to its enactment.

Legislation

With the enactment of Public Law 566 in 1954 and Public Law 984 in 1956, which provide financial assistance to small watershed and small reclamation projects, a large number of water projects were proposed for development during the biennium. Thus far the department has reviewed, or is investigating, 67 applications under these programs.

Chapter 2052, Statutes of 1957 (state assistance to small water projects) which was passed by the Legislature in the biennium will give further impetus to water project development. The law also provides for fish and game preservation and enhancement assistance in project development.

Other legislation of signficance includes the addition of Section 1257 to the State Water Code. This section gives clear-cut authority to the State Water Rights Board to condition water permits for the protection of beneficial uses of water and cites fish and wildlife as one of these beneficial users of water.

WATER PROJECT ACTIVITIES

Following are several of the more important water project activities in which the department was engaged during the biennium:

State Water Rights Hearings

Effective July 5, 1956, the office of the State Engineer was abolished and the duties of that office pertaining to the appropriation of water were vested with the newly created State Water Rights Board. The board is in the process of acting on a tremendous backlog of applications to appropriate water, and expediting filings of many year's standing. The department reviewed more than 822 applications for water rights filed with the State Water Rights Board during the biennium and protests were filed against approximately half of these applications to protect the water needs of fish and wildlife. Most of these applications require a field investigation to determine the effect of the proposed water diversion on fish and game. In some cases extensive negotiations between the department and the applicant have been required to resolve the problem of anticipated damage to fish or wildlife. Twenty unresolved cases resulted in formal hearings before the State Water Rights Board. These hearings involved considerable preparation and the presentation of extensive testimony.

Although major issues were at stake in most of these hearings, those of the American and San Joaquin Rivers are particularly significant. The former case was heard in 1956-57 and resulted in a favorable decision by the board which concurred in the recommendations of the department for protection of water supplies for the fisheries resources. The Bureau of Reclamation, Sacramento Municipal Water District, and the department had previously agreed on the measures necessary to protect fish and game.

The San Joaquin hearings have no precedent as far as the department is concerned. Currently, the San Joaquin River frequently goes dry between Mendota and the mouth of the Merced River. The department is seeking to obtain water to rehabilitate the river's salmon runs, which have been decimated by almost complete diversion of the entire flow of the river. Major legal and economic aspects are involved. The hearing was still in progress at the close of the biennium.

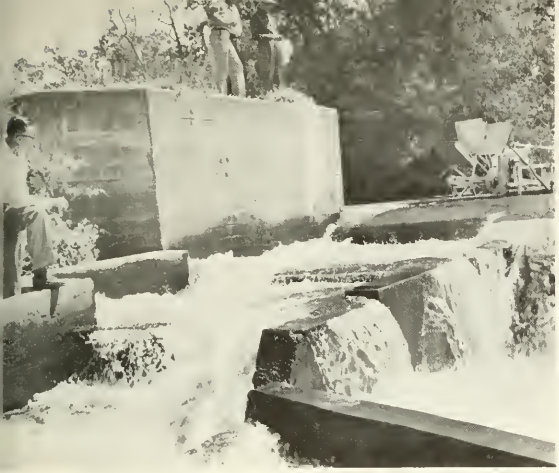
Applications for water rights for the proposed Ruth Dam project on the Mad River in Humboldt and Trinity Counties by the Humboldt Bay Municipal Water District were the subject of a hearing before the State Water Rights Board in June, 1958. After extensive negotiations, agreement was reached with the district on provisions for water releases and other measures to protect the Feather River fisheries.

In each of the above hearings, a heavy workload was incurred in investigation the resources affected by the applications and in preparing and presenting testimony to protect the water needs of fish and game.

These hearings are most important because the decisions rendered will determine the survival of many of our fish and wildlife resources for all time.

Federal Power Commission Project Applications

A total of 59 applications and permits involving 53 separate projects, under the jurisdiction of the Federal Power Commission, were reviewed or acted upon during the biennium. These projects usually involve high dams, intermittent or widely fluctuating water releases, and frequently they are barriers to anadromous fishes. Thus, they often entail extensive investigations by fisheries and wildlife personnel. Recommendations most often call for expensive modifications in the



Fish ladders help salman and steelhead ta pass dams blacking passage ta upstream spawning beds.
—Fish and Game Photo

project or compensation for fishery damages in the form of streamflow maintenance, hatcheries or other facilities. Thirty of the 59 projects under review required investigations and negotiations of some magnitude. Seven projects were of major proportions and would have serious effects upon fish and wildlife.

Since about 1917 the flow of the Klamath River has been manipulated by the California-Oregon Power Company through its dam (Copco Dam) and power installation near Copco, California. The severe fluctuations in the river are a hazard to fishermen and annually strand millions of fish, including king salmon and steelhead.

Although the department has been negotiating for many years with Copco to alleviate the condition, little success has been attained. In 1950, the matter was taken to the courts where a legal battle ensued over matters of jurisdiction. In 1957, Copco applied for an F. P. C. license to construct a dam and powerhouse at Irongate (seven miles downstream from Copco) and to license its existing plants. The department intervened in the matter before the power commission and negotiations were begun with Copco relative to provisions for fish and wildlife.

During the biennium, negotiations have revolved around eliminating the nuisance caused by the severe fluctuations in the river and matters relative to a hatchery and facilities to compensate for loss of salmon and steelhead spawning areas above the Irongate Dam site.

At the close of the biennium, an extensive two-month survey was under way to determine the magnitude of fish losses under a revised schedule of releases proposed by Copco.

The department has intervened in the applications of P. G. & E. and Copco for Federal Power Commission licenses for power developments on the Pit and McCloud Rivers. Studies of the probable effects of the projects on fish and wildlife were initiated.

The applications of the East Bay Municipal Water District for a power license and water rights permits for further development of the waters of the Mokelumne River have posed a threat to the salmon and steelhead runs of that river. Field studies and negotiations with E. B. M. U. D. continued through the biennium. No permanent solution to the problem of maintaining the Mokelumne River fisheries which would be satisfactory to both agencies had been found.

The Belden Project proposed by the Pacific Gas and Electric Company on the North Fork Feather River was the subject of study. Recommendations proposed by the department, United States Fish and Wildlife Service and Forest Service have not yet been accepted by the company and the matter remains unresolved.

The Federal Power Commission license for the state-sponsored Oroville Dam Unit of the Feather River Project was conditioned for protection of fish and wildlife based on recommendations of the department, and Fish and Wildlife Service.

U. S. Army Corps of Engineers, Flood Control Projects

The department investigated 26 flood control projects proposed by the Corps of Engineers. All but two required extensive investigation as to the effect of the projects on fish and wildlife; 11 required no action.

Several projects, particularly one on the Russian River, may have serious adverse effects on anadromous fishes. These projects are now under study and negotiation.

U. S. Army Corps of Engineers Navigation Projects

Only four projects in this category were actively investigated by the department in the biennium. Two of these are still under investigation and recommendations have been made for two. They are the Santa Cruz, Monterey, and Princeton Harbor Projects and a private undertaking on Lagunitus Creek. The latter was unique in that it involved an exchange of state lands for private lands in a stipulation between the department and the applicant providing public access to public fishing waters.

U. S. Bureau of Reclamation Projects

Twenty-four projects proposed, or being studied, by the Bureau of Reclamation were received, but nine of these did not require action. The others required more detailed study and field investigation.

Agreement was reached with the bureau on stream flow maintenance below the Monticello Dam on Putah Creek in Yolo and Solano Counties and similar agreements were being consummated at the end of the biennium on flow releases below the bureau's Lewiston and Trinity Dams on the Trinity River and Whiskeytown Dam on Clear Creek.

Dead stripers from the dromatic fish kill in San Francisco Bay.
—Fish and Game Photo

Small Reclamation Projects (P.L. 984)

During the biennium, the department reviewed 27 applications under this program. All but six, which would have no effect on fish and wildlife, were under investigation by the appropriate regions. Recommendations for protection of fish and wildlife resources were made in the case of nine applications and five of these included enhancement features.

An application by the Jackson Valley Irrigation District is unique in that enhancement features for fish and wildlife recreation call for an expenditure of more than $250,000. The project plan calls for additional water storage for fishery purposes, access features, and sanitary and recreational facilities.

Small Watershed and Flood Prevention Projects (P. L. 566 & 1018)

Forty applications for federal aid under this law have been reviewed by the department in the biennium. Of these, 18 were found to have no adverse effects or enhancement possibilities. The remaining 22 are under investigation. Tentative recommendations have been made on nine of these but are subject to revision until the project plans are more complete.

Several of these projects present serious problems or enhancement possibilities for fish and wildlife. As in the case of P. L. 984 projects, investigations and recommendations concerning these projects usually involve water releases for the maintenance of fish life, fish passage facilities, reservoir storage for fishery compensation or enhancement, access problems, etc.

Major Disaster Projects (P. L. 875)

The department reviewed 178 applications for federal aid under this law. As provided by Fish and Wildlife Co-ordination Act, these applications must be submitted for review by the Department of Fish and Game for adverse effects on fish and wildlife.

Dam Applications

Thirty-three dam applications were reviewed for their possible effects on fish and wildlife. Several of these require further investigations regarding the need for fish ladders. Fish trapping facilities were recommended at one.

WATER PROJECTS—CONTRACT GROUP

A group of fish and game specialists from the department's water projects section operates under a service agreement with the Department of Water Resources. Members of this group participate in the early planning stages of developments outlined in the California Water Plan.

The important projects studied and reported on during the biennium were the Northeast Counties, Upper Feather River, and Salinity Control Barrier. These involved recommendations for stream flows, evaluation of effects on fish and wildlife resources and means to preserve or enhance the existing fisheries.

Studies were begun on the North Coastal Area Major Development Plan. Ultimate development of this area involves the export of about 12,000,000 acre-feet of water annually from the north coastal area.

Other important but smaller local projects were evaluated and reported on. Table 45 in the appendix lists the projects and their status at the end of the biennium.

POLLUTION

Water pollution control activities of the department, as well as other regulatory agencies, increased significantly during the biennium. To a large degree this increase can be attributed to a growing awareness and desire on the part of the public for positive measures to effectively eliminate the wasteful and destructive effects of pollution.

California is witnessing a population growth which might appropriately be called an explosion. At the beginning of the biennium there were 13,600,000 Californians. By 1975 a projection of anticipated growth points to a population of 26,343,000 and by 1980 the State will probably number over 31,000,000.

At no time in California's history has it been more apparent that the future of fisheries, wildlife, and recreational resources is completely dependent upon adequate supplies of unpolluted water. Intensified pollution control action and realistic planning for water quality management in the future are essential to fish and game management in California.

Since 1949, and the inauguration of California's Water Pollution Control Law (the Dickey Act), state and regional water pollution control boards have been the agencies directly responsible for the regulation of waste discharges and the control of water pollution. It is the duty of the regional boards to determine the beneficial uses of the receiving waters which are to be protected and to prescribe appropriate waste discharge requirements for the protection of these beneficial uses.

Although the department has clear authority to act in cases of "one-shot" pollution which may be detrimental to fish and aquatic life, cases of chronic and continuing pollution must be referred to the regional boards for corrective action.

While regional board actions have generally met with co-operation on the part of waste dischargers, it is the opinion of the department and other state agencies that effective control action has in many cases been hampered by certain inadequacies and inconsistencies in the law.

At the end of the biennium an Assembly Interim Committee on Bay and Water Pollution was established to evaluate the statewide effectiveness of the law. The Department of Fish and Game, acting in conjunction with the Departments of Public Health, Water Resources, Agriculture and Natural Resources submitted to the committee a series of 15 recommended changes in the law. It is anticipated that these and other recommendations will be considered by the committee for legislative action in the 1959 Session.

The formation of the Assembly Subcommittee on Bay and Water Pollution was largely motivated by public indignation arising from a disastrous fish kill in San Francisco Bay. The kill, occurring along the Richmond Shore in May, 1957, destroyed an estimated 2,000 legal-sized striped bass as well as tremendous numbers of smaller fish and invertebrates. After extensive field and laboratory investigation by the department, sufficient evidence was gathered to institute civil proceedings against a large manufacturing firm. At the end of the biennium the case was still awaiting court action.

S. F. Bay Fish Kill

Although the San Francisco Bay fish kill was tragic in terms of the needless loss of fish life, it served the purpose of graphically pointing out the need for research on the effects of various pollutants on aquatic life. Bioassays on the effluent in question could have demonstrated the toxic components of the discharge, the degree of toxicity, and could have revealed the likelihood of a kill under certain predictable conditions of dilution.

Very simply, the bioassay test consists of exposing fish or other test animals to a range of concentrations of a toxic substance over a definite time period. On the basis of the mortality rates in the various test solutions, "safe" concentrations for long-term exposure can be calculated.

The value and applicability of such work is obvious. It has also become obvious that the department will be called upon with increasing frequency to provide such technical data and assistance to Regional Water Pollution Control Boards. During the biennium over 1,000 applications for waste discharges were filed with the regional water pollution control boards. Many of these were of great significance to fish and aquatic life and were investigated by department personnel. The boards have generally shown a willingness to prescribe discharge requirements which recognize the importance of fish and aquatic life. They are looking to the department for the technical data necessary for the writing of appropriate discharge requirements.

In an effort to fulfill this obligation and get the facts, the department has secured approval to set up a new technical class of employee—pollution bioanalyst. These people, trained to evaluate the effects of pollution on aquatic life will be assigned to Regions 3 (San Francisco) and 5 (Los Angeles) early in 1959, and other regions may have this type of help in the near future. In addition, the department is making plans for laboratory facilities for both fresh water and marine pollution investigations.

Major Activities

During the biennium the department, although seriously hampered by lack of manpower and facilities, has increased its pollution investigation work. In addition to hundreds of smaller studies and actions the

A square foot area in a pocket that had been covered by the previous high tide contained five dead shells, three with meat and two without, on the beach at White Point near San Pedra. Tagging experiments showed that it required just about a year in the polluted White Point soup before all the abalones ended up in this condition.

—Fish and Game Photo

following represent some of its major pollution control activities:

1. A study to determine the economic importance of fishing and water sports recreation in the Los Angeles-Long Beach Harbor. Approximately 45 percent of the State's live bait catch is taken in the confines of the outer Los Angeles Harbor. During the biennium the value of this fishery to the bait boats alone was approximately $600,000 per year. The value of the party boat fishery, dependent upon Los Angeles Harbor bait, was estimated to be over $1,500,000 per year—making a total annual value to the economy of over $2,000,000 per year.

The department is concerned over the possibility that increasing waste discharges into the Inner and Outer Los Angeles Harbors will jeopardize this valuable resource. The Inner Los Angeles Harbor, once a source of live bait is now essentially sterile due to waste discharges. Since the inner and outer harbors are contiguous, increases in poorly treated industrial wastes may ultimately degrade the outer harbor as well.

The major waste discharge into the Los Angeles Harbor is via the Dominguez Channel which receives wastes from about 18 major industries. The flow from the channel is approximately 30,000 gallons per minute and except during rainy weather consists almost entirely of waste water from the discharging industries. Bioassays indicate that concentrations above 0.72 percent in the receiving water will be deleterious to fish life.

2. Since July, 1956, the department has conducted bioassays on the City of Los Angeles Hyperion sewage treatment plant effluent. This work has been conducted for the Los Angeles Regional Water Pollution Control Board as part of the board's monitoring program. Results thus far indicate that no direct toxicity can be demonstrated in areas of Santa Monica Bay designated by the board to be protected for aquatic life and fish propagation. At the end of the biennium, plans were under way for a similar bioassay testing program on Los Angeles County's White Point sewage treatment plant effluent.

3. The department expended a considerable amount of effort working with regional water pollution control boards and other state agencies on the problem of a potentially expanding pulp and paper industry in California. The industry needs both a ready supply of timber as well as a large supply of very high quality water in order to operate economically and has expressed plans for installations in the Redding area as well as the Rio Vista area along the Sacramento River. Since the Redding area of the Sacramento River supports the most important king salmon spawning area in the state, the department insisted upon, and the regional board has written, waste discharge requirements which are designed to prevent any damage to the fisheries resource. By the end of the biennium it was not certain whether or not the pulp mill would be constructed in this sensitive area.

Santa Monica Bay

Late in 1957, the City of Los Angeles instituted a continuing program of trawling in Santa Monica Bay as a basis for measuring long-term changes in fish populations brought about by the sewage discharge from its Hyperion Treatment Plant. A series of about 30 survey stations in water ranging in depth from 60 to 600 feet are occupied each quarter using a 24-foot shrimp tri-net. The department has an observer aboard the city's boat during all trawling operations and all fish and invertebrates taken in this work are examined at the California State Fisheries Laboratory. A record is kept for each species listing drag number and date, length, weight and sex. Notations are made regarding state of maturity, food habits, age and particularly any abnormalities observed.

A new sludge outfall, which discharges seven miles west of Hyperion, was put in operation late in 1957. A new effluent outfall which will discharge five miles west of the plant is under construction and will be in operation in the near future.

With the information gathered from the trawling work, the department will be able to assess the amount of change in fish populations and any danger to them brought about by the discharges from the new outfalls.

Black Abalone Transplant Experiment

To assess the effect of the White Point sewer outfall upon abalones in the area, a double transplant and tagging operation was carried out at the end of the previous biennium. Several hundred black abalones were gathered at Bird Rock and Catalina Harbor, Santa Catalina Island, and transported to White Point where they were tagged, measured, weighed, and transplanted. A similar transplant was made back to Santa Catalina Island.

It took less than a year for all but one of the Catalina Harbor black abalones to die in the White Point area. One individual of this transplanted lot lasted for 13 months prior to being found on its back at the high tide line—completely defunct.

At Catalina Harbor, a number of the White Point abalones lived and prospered. Several were found during the winter of 1957 and all had healthy animals in shells that showed, in some cases, more than three-quarters of an inch of new growth at the margin.

Inland Fisheries

Castle Lake, Siskiyou County, with Mt. Shasta in the background. The department has conducted angler use studies on this lake.
—Fish and Game Photo by Joe Wales

Highlighting inland fisheries developments were increased hatchery production at reduced costs, elimination of commercial fishing from the Sacramento-San Joaquin Delta, establishment of a silver salmon run in the Sacramento River, proof of the threadfin shad's value as a forage fish, and many new waters opened to public fishing. All but the commercial fishing and silver salmon (see Salmon and Steelhead section) are detailed in this portion of the biennial report.

Water utilization projects continued to require a great deal of investigational work to protect existing fisheries threatened by alteration of habitat, as well as to provide fishing in the new habitat resulting from these projects.

Listed in Table 30 are some of the major new reservoirs first opened to public fishing during the biennium. By far the largest, and perhaps most important, of these is 19,600-acre Berryessa Reservoir created by the Monticello Dam on Putah Creek. This large reservoir was stocked with smallmouth bass, largemouth bass, redear sunfish, and white catfish during 1957. By the spring of 1958, excellent fishing was being enjoyed by thousands of anglers.

If this fishery follows the pattern of other reservoirs of this type, it will remain good for several years and then decline.

Learning how to maintain the excellent fishing that exists for the first few years in most large warmwater reservoirs is one of the department's most challenging problems.

Existing and proposed new reservoirs have a tremendous angling potential. These reservoirs fall into a number of diverse categories, some of which are:

(1) Coldwater regulating reservoirs such as those formed by Keswick and Nimbus Dams.

(2) Warmwater reservoirs such as Lake Havasu.

(3) Large, primarily warmwater, fluctuating reservoirs such as Folsom, Shasta, and Millerton Lakes.

(4) Coldwater reservoirs such as Edison and Huntington Lake.

(5) Waters that provide habitat for both trout and warmwater fishes, such as Lake Hennessey, Big Bear Lake, and Isabella Lake.

Each category, and often each reservoir, presents unique management problems. How to produce the maximum amount of fishing in these reservoirs will require all-out effort by fisheries research and management personnel in future years.

Big Bear's Unique Program

In a co-operative program that may well point the way to vastly improved fishing and better business in California's most popular mountain resort areas, the community of Big Bear Lake formed a park district and taxed itself $45,000 a year in both 1957 and 1958 for the sole purpose of purchasing commercially reared trout to supplement those stocked in their lake by the Department of Fish and Game.

The community reasoned that when the economy of an area is based largely on public recreation it makes sense that the commercial enterprises and property owners of that area should help provide the recreation that supports their business and property values. They stocked Big Bear Lake with more than 20 tons of trout in 1957 and some 32 tons of trout in 1958. The venture paid off so well businesswise, that the program will be continued indefinitely.

TROUT

During the period covered by this report the department operated 15 trout and salmon hatcheries and one rearing station, and planted a total of 47,784,267 trout and salmon weighing 3,736,780 pounds. Catchable trout, averaging approximately eight inches in length, made up 33 percent of the total number and 89 percent of the total weight.

The following trout and salmon hatcheries were operated during the biennium: Mt. Shasta, Crystal Lake, Darrah Springs, Cedar Creek, Nimbus, Moccasin Creek, Hot Creek, San Joaquin, Fish Springs, Mt. Whitney, Black Rock Rearing Ponds, Sequoia, Moorehouse Springs, Kern River, Fillmore and Mojave.

Two outmoded hatcheries, Tahoe and Yosemite, were closed. Both of these stations were high cost per pound units and could not be brought up to a state of higher efficiency. Waters formerly stocked by these hatcheries are now being planted by airplane with fingerlings produced at modern and larger hatchery units at a lesser cost.

Wildlife Conservation Board funds made it possible to construct new broodstock ponds and spawning facilities at the Mt. Shasta Hatchery. This installation has an ultimate capacity of 21,000,000 eggs. Those facilities are of the latest design and contribute much

Big Bear Lake in the San Bernardino Mountains.

—Fish and Game Photo

New brood stock ponds and spawning house at Mt. Shasta Hatchery. Fish are pushed into the spawning house without removing them from the water, resulting in less injury to the fish and better quality eggs taken.

—Fish and Game Photo

to the health of the brood stock. Excellent eggs are obtained at this station and are distributed widely to other hatcheries.

Several fish transportation trucks were remodeled to incorporate newly developed features in tank design. These features include a pump intake underneath a raised screened floor, and the distribution of the aerated, recirculated water either by spray or injection near the top of the tank.

These changes, especially the raised screen floor, greatly reduced the tendency of the fish to congregate in areas of low circulation and smother from lack of oxygen. Furthermore, they increased carrying capacity. A 500-gallon tank was reduced to 400-gallon capacity, while its fish-hauling capacity was increased from an average of 700 pounds to 1,200 pounds per load.

Sufficient brood stock of the nearly extinct Eagle Lake trout have been retained at Crystal Lake Hatchery to insure the perpetuation of this species. Plans have been made for an artificial propagation program to assist the Eagle Lake trout fishery. A fish-counting weir, and a trapping and egg collecting station are to be installed on Pine Creek, the lone spawning tributary for the Eagle Lake trout.

Fish Feed

Considerable progress in the use of dry food at state hatcheries was made. With a steady decrease in purchase of meat products for fish food, the use of dry pellet-type feeds is becoming more important economically each year. Fortunately, dry feeds which provide a nearly complete diet for trout and salmon are now available from commercial manufacturers. However, at some hatcheries it is still necessary to feed a meat and ocean fish diet one or two days a week as a supplement to the dry feed, because the fish have not done well when fed only dry feed.

Two devices for dispensing dry feeds were developed by department personnel. A pellet blower mounted on a pickup truck for blowing pellets into rearing ponds and a modified valve funnel for use in feeding powdered and granular-type feeds to troughs and nursery tanks have proven highly satisfactory.

In spite of the rising cost of doing business because of inflation, the cost of producing trout decreased from 85 cents per pound in the 1956-57 Fiscal Year to 77 cents per pound in the 1957-58 Fiscal Year.

Perforated aluminum grates for pushing broad fish into the spawning house at Mt. Shasta Hatchery.

—Fish and Game Photo

Pellet blower for blowing fish food pellets into raceway ponds provides better distribution of food and reduces time required in feeding.
—Fish and Game Photo by Hal Wolf

Trout Brood Stock Improved

Efforts were continued to improve California's trout hatchery brood stock, with much of the emphasis placed on adjusting spawning periods to fit more closely with hatchery production schedules.

Selective breeding and the introduction of new strains have extended the spawing period. Because of the small volume of water required, trout egg incubators have proved highly successful. It is possible to heat or cool water to obtain specific temperatures which control the rate of egg development.

The combination of altered spawning periods and controlled water temperatures during egg incubation and hatching resulted in lengthening the period of time that trout eggs and fry are available to the hatcheries. This improved timing permits better scheduling of hatchery production and assures the desired number of trout of the correct size for planting when required.

Disease Investigations

Inland Fisheries Branch disease specialists were kept busy assisting the state hatcheries with disease and nutrition problems, as well as inspecting loads of live fish imported from other states and at California's commercial hatcheries. It is extremely important that all planted trout, whether state or commercially reared, be free from any disease that can be transmitted to wild fish.

During the biennium, 180 shipments of live trout entered California from other western states. This number of shipments represents approximately 1,800,000 live trout. In almost all cases the fish being imported were in good condition. Only one shipment

Trout fingerlings in hatchery traughs being fed dry food granules with a modified valve funnel.
—Fish and Game Photo by Joe Wales

was found to be seriously diseased, and it was not allowed to enter California.

Most of the diseases and parasites at state hatcheries responded readily to treatments. Controlling the gill fluke *Sanguinicola davisi* at Darrah Springs Hatchery required an approach not usually employed in hatcheries.

Because no drugs or chemicals were known to control this parasite, a biological method was employed. After the life cycle of this worm had been studied it became apparent that removal of the snails (which were found to be the intermediate hosts) and the wild fish (the definitive hosts) from the water supply would break the life cycle. The water supply ditch was cleaned with a bulldozer which mechanically removed many snails as well as the aquatic plants important in their habitat. The water supply was treated with chlorine which removed the fish. After a short period it was found that a few fish had survived in the water supply.

Due to the hatchery production schedule, it was not possible to retreat the water supply. However, in the following year's fish production it was found that the gill fluke had been virtually eliminated, and no losses of fish were attributed to the parasite.

TROUT RESEARCH

Much of the effort of the federal aid trout research project was devoted to a search for methods of improving the state's large catchable trout planting program. Approximately 500 waters are managed as catchable trout fisheries, and by far the largest portion of the department's inland fisheries budget goes toward this program.

The project has developed a statistical procedure from which the number of trout ultimately caught from any particular plant can be determined from a few days of field work. These field methods and statistical procedures have been tested on 28 catchable trout waters. In the great majority of the waters studied thus far, more than 50 percent of the planted trout are caught.

Some waters have shown a return in excess of 90 percent of a plant. These are represented by June Lake and Rush Creek of Mono County, Green Valley Lake and the South Fork Santa Ana River of San Bernardino County, and Little Truckee River of Sierra County. In general, such high returns are a reflection of high angling pressure, as shown below.

California catchable trout waters support angling pressure which far exceeds that found in wild trout waters. The project has found that the angling hours per acre per day of catchable trout waters exceed the angling hours per acre *per year* of most wild trout fisheries.

The department is further analyzing angler use on catchable trout waters by comparing the number of fish planted in a given water with the total angler hours of fishing on that water.

Name of water	*Percentage harvest of plant*	*Angler hours per acre per day*
South Fork Santa Ana River	98	131
Green Valley Lake	98	51
June Lake	99+	4
Little Truckee River	99+	29
Rush Creek	90	78
Gregory Lake	83	17
South Lake	74	3
Butt Creek	73	36
West Carson River	70	37
East Carson River	60	16

Upon completion of the statewide studies the department will be in a better position to improve and further standardize the catchable trout program throughout the state. Quality of catchable trout management depends upon the accuracy and application of information on number of trout planted per angler hour and the percentage return of those trout.

MANAGEMENT EXPERIMENTS

The experimental trout management work in the Lakes Basin Recreation Area of Sierra County continued. In this area different species and strains of trout

Planting Trout

—Fish and Game Photo

Young carp removed by poisoning at Puddingstone Reservoir, Los Angeles County.
—Fish and Game Photo

are being tested to determine which are the most suitable for the various types of California trout waters. At Upper Sardine Lake subcatchable rainbow trout (average size 4.7 inches) have returned well. This is in contrast with the poor returns from earlier plants of fingerling trout. It is believed that in planting subcatchables the competition between trout and the lake's large population of Tahoe suckers has been overcome.

Fingerling survival of brown trout in Lower Sardine Lake continued to be poor, with some strains doing slightly better than others, but none doing well enough to conisder the planting of fingerling brown trout as a proper management tool for this lake.

The eastern strains of catchable-size brown trout that had been planted in Lower Sardine Lake continued to show a higher return than catchable-sized brown trout reared from eggs taken in California. All strains have shown good growth in the lake after planting and, instead of being caught out in the first few weeks, have entered the catch over a two- to three-year period.

During the spring of 1958, a group of catchable brown trout of the California strain and a group of catchable brown trout from the long-domesticated Massachusetts stock were planted together into the lake from Fillmore Hatchery. While these fish were being reared in the hatchery, the Massachusetts fish grew twice as fast as the Mt. Whitney strain, and their survival in the hatchery was almost two-thirds greater. Returns so far have been much greater from the Massachusetts fish, but this may be only the result of their larger size when they entered the lake. The final test on catchable brown trout in this lake will be made in 1959, with equal plants of three different strains of brown trout being used.

The principal study conducted at Upper Salmon Lake involved the testing of different strains of rainbow trout fingerlings for natural spawning capability. This was done by checking the rainbow trout through a counting weir, as they migrated to the spawning areas in the only tributary to this lake. During the late summer of 1957, three different strains of rainbow trout fingerlings were planted. The survivors from these plants will probably enter the spawning stream during the springs of 1959 or 1960.

At Packer Lake it was found that eastern brook trout from eggs supplied from Massachusetts produced returns many times greater than brook trout reared under identical conditions but from eggs supplied from the State of Washington. As a result of this test, a large number of brook trout eggs was ordered from Massachusetts. The eggs are to be used for the regular fingerling planting program.

In the Castle Lake, Siskiyou County, investigation, which was begun in 1941, the principal objective during the biennium was to discover the optimum number of fingerling trout which should be planted per acre in such mountain lakes. This figure appears to be about 300. Further tests are under way to determine if smaller or larger numbers would provide more angling recreation.

ROUGH FISH CONTROL

During the period covered by this report, 26 trout lakes were chemically treated and restocked. Appendix Table 31 lists these lakes.

One of the most successful fisheries management projects of the biennium was the chemical treatment of Big Bear Lake, in the San Bernardino Mountains, in the fall of 1956 and the restocking of trout in the lake. The chemical treatment removed some 250 tons of stunted adult crappie, weighing only two ounces apiece, that had been utilizing most of the lake's fish food and growing room.

In January of 1958, 75,000 rainbow trout fingerlings were stocked in Big Bear and catchable-size trout were planted in the lake at regular intervals throughout the spring and summer. The result was the best fishing in Big Bear Lake's history. Creel checks showed that fishing was four times as good as it had been in the previous year. Although planted trout had put on very

Kokanee Rescue. Mid-December rains in 1957 triggered a spawning run of Kokanee up the tributories to Lake Arrowhead in the San Bernardino Mountains. Since eggs would be left high and dry when the stream flow dropped, the Department of Fish and Game rescued spawners by trapping them (in photo top left and bottom left) and took their eggs which were placed in the department's San Joaquin Hatchery. The resulting salmon fry were restocked the following spring in Arrowhead and the resulting fish (sample at right) has been phenomenol.
—Fish and Game Photos

KOKANEE

RESCUE

little growth in 1956 while in competition with the swarming crappie, they grew better than an inch a month in 1957. The relatively inexpensive fingerlings stocked in January put on such good growth they provided more than half of the trout caught from mid-July on through the fall.

Bridgeport Reservoir, Mono County, was chemically treated in October, 1955, when the reservoir was at an extremely low level, to remove a large population of carp. Unusually heavy runoff during the winter and spring of 1955-56 filled the reservoir for the first time in years and provided excellent water conditions for the fingerling and catchable-size rainbow trout restocked into the reservoir in the spring and summer of 1956. Fishing was surprisingly good in the late part of the 1956 season and was phenomenally good in 1957, when limit catches of 1½- to 2-pound average rainbows were the rule. Trout growth in the carp-free water was so excellent that subcatchable-size rainbows stocked in the spring of 1958 provided the Bridgeport area's best fishing during the summer and fall. The improved fishery was quickly reflected in increased angler activity. Prior to the treatment, Bridgeport Reservoir normally attracted 30 to 40 boat-fishing parties for opening day. On opening day of 1958 more than 700 boats were on the reservoir.

FLOW MAINTENANCE

Rutherford Lake Flow Maintenance Dam was completed with Wildlife Conservation Board funds during 1956. This dam and Lillian Lake Dam assure a flow in the West Fork Granite Creek, Madera County, during late summer periods. Cow Meadow Dam was rebuilt and two saddle dams were repaired on Cherry Creek in Emigrant Basin, Tuolumne County.

Flow-measuring weirs were built below five lakes in Emigrant Basin so that releases can be measured each year to keep Cherry Creek flowing with stored water.

Highland Lake Dam, El Dorado County, was completed to improve flows in the Rubicon River. A debris-clearance crew removed unsightly snags, the remains of trees killed by raising the lake levels at Big Downey Lake, Nevada County, and at Buck Island and Rockbound Lakes, El Dorado County. A lake level maintenance dam was constructed on Wheeler Lake, Alpine County, to deepen it and prevent periodic winter kills. Investigations have been continued to find new places where stream flow maintenance dams are needed. Good dam sites are becoming scarce, and it appears that the flow-maintenance dam program in many areas is almost complete.

The Southern California stream improvement program, made possible by Wildlife Conservation Board allocations, was completed at the end of the biennium. The chief function of this project was to create additional pool areas in Southern California streams. During its last two years of operation this project constructed 71 new stream improvement devices.

KOKANEE SALMON

The first salmon spawning run in the history of Southern California's San Bernardino Mountains area ended at Lake Arrowhead in late December, 1957, and the department collected an additional half million kokanee salmon eggs as the result of it.

The fertilized eggs were placed in troughs at the DFG's San Joaquin Hatchery, near Fresno, from which the bulk of the resulting salmon fry were restocked into Arrowhead early the following spring.

The kokanee is a small-sized, land-locked strain of sockeye salmon and, like all true Pacific salmon, inevitably dies after spawning.

In Lake Arrowhead, where 200,000 fry were experimentally introduced in April of 1955, the kokanee reached 10 inches in length in two years and produced phenomenally good fishing in the spring of 1957. They averaged 12 to 14 inches in length when they spawned in December, 1957, in their third year.

The spawning run at Arrowhead was triggered by mid-December rains that turned the lake's nearly dry tributaries into sizable streams. Since eggs deposited in the streams would be left high and dry when the streamflow dropped, a DFG crew netted the spawning fish and took every egg they could get. Eggs stripped from the female kokanee were fertilized with milt from the males and each day's take was rushed to San Joaquin hatchery.

If all goes well, Lake Arrowhead should again have good kokanee fishing by late fall of 1959 or early spring of 1960. The lake's trout fishing will continue as usual and the relatively few kokanee that did not mature in 1957 will be there for catching in 1958.

WARMWATER FISHES

The major effort of the statewide warmwater research program was directed toward the evaluation of the threadfin shad introduction into the Colorado River. The shad, imported from Tennessee in 1953 and planted in the Colorado River in 1954, was expected to supply sorely needed forage for largemouth bass and other warmwater game fishes.

Much field and laboratory work connected with the shad investigation was completed during the biennium. The results demonstrated that the shad helped both the game fish populations and fishing success in Lake Havasu on the Colorado River. The largemouth bass responded to the shad with an increased growth rate and better survival. The average increase in growth for bass was about two inches for each year of life.

The black crappie fishery in Lake Havasu was stimulated greatly by the shad. Prior to 1955, crappie

fishing was of negligible importance; however, in the winter of 1957-58 crappie were providing the most successful angling in the area. The average catch per angler effort was about five crappie, compared with an average catch of 0.06 crappie in 1950-51.

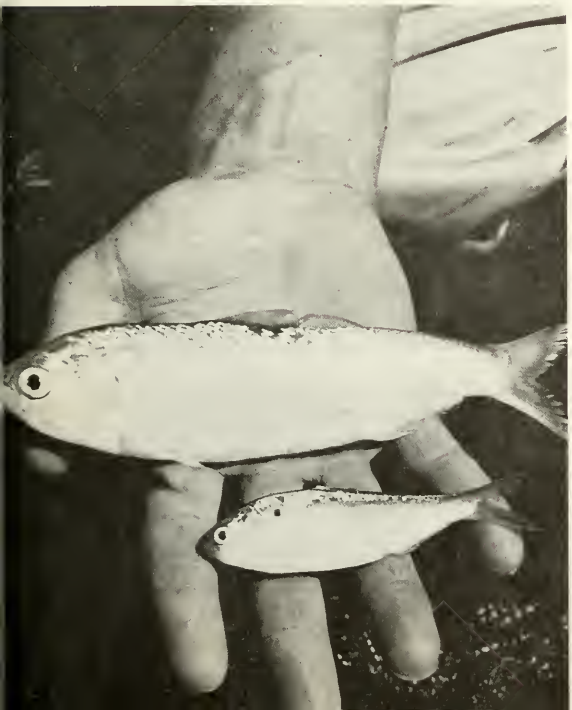
The effect of the shad on the important channel catfish population of the Colorado River was not well defined. There were some indications that growth had improved slightly; however, the pre-shad growth rate was so variable because of other environmental factors that the response to the improved forage fish supply was obscured. Since knowledge of the biology of the shad is fundamental to a complete evaluation of its effect in the Colorado River and its possible effects in other California waters, it was imperative that life history data be secured rapidly.

The food habits, growth rates, reproductive characteristics, and early development were investigated. These data were utilized to predict the possible consequences of an introduction of shad into the Sacramento-San Joaquin Delta. It was concluded that the benefits from such an introduction would outweigh any possible harm to existing delta fisheries.

Tagging Studies

The development of adequate methods for obtaining accurate measurements of the mortality rates within

Threadfin shad (larger one eight inches) taken from an Imperial Valley irrigation ditch that drains into the Salton Sea.
—Fish and Game Photo



Full-grown gulf croaker from the Salton Sea. Introduced as food for larger game fish, this small sciaenid species from Mexico's Gulf of California is now the principal food of larger corvina.
—Fish and Game Photo

California's natural warmwater fish populations received considerable attention. This type of information is difficult to secure; nevertheless the demand for such data is urgent in view of greatly expanding fishing pressure, particularly in Southern California.

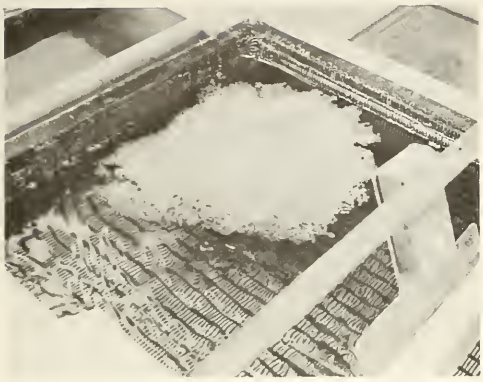
Mortality data can best be obtained through tagging studies, consequently much effort was expended on the development of efficient tags and tagging techniques. Sutherland Reservoir, a municipal water supply reservoir in San Diego County, was established as a test water for tag experimentation. Complete creel censuses, in connection with a largemouth bass tagging study, were operated during the 1956, 1957, and 1958 fishing seasons. The results demonstrated that the disk dangler tag, used in the department's successful catfish tagging studies, is also the most suitable tag for largemouth bass.

The Sutherland Reservoir experiments will eventually show how largemouth bass populations react to various levels of fishing and at what level the population should be harvested to obtain the best fishing during following years.

Economic Value

An estimate of the economic value of fishing in California's warmwater lakes and reservoirs was determined by personal interviews in 1956, in co-operation with the California Department of Water Resources. The expression of warmwater fishery values in monetary terms is vital to the proper planning and development of water projects. It was found that an average of $12.50 was spent daily by largemouth bass, crappie, sunfish, and catfish anglers. The total annual recreational value, in terms of actual cost to the angler, of warmwater fishing in California was about $46,000,000.

Central Valleys Hatchery and Chino Fisheries Base continued their roles as the centers for warmwater fish salvage and transplanting. Appendix Table 35 lists the number of fish. The great difference in totals be-



Catfish eggs being agitated at Elk Grove Warmwater Fish Hatchery.
—Fish and Game Photo

tween 1956-57 and 1957-58 reflects the poor black bass spawning season experienced in the spring of 1958, when heavy rainfall and high winds caused a heavy mortality in newly hatched bass fry.

The All-American and Coachella canal systems that carry irrigation water from the lower Colorado River to the Imperial and Coachella Valleys of Southern California began drawing really heavy angler use for the first time. The big change came in the spring of 1957, when crowds of fishermen such as those associated with the opening of trout season lined the banks of the Coachella canal near Niland and the All-American canal near Winterhaven to share excellent catches of channel catfish and largemouth bass.

Pine Flat Crappie

Censuses carried on at Pine Flat Reservoir, Fresno County, during the 1956-58 period revealed that about 25,000 anglers use this reservoir each year. What was developing as a smallmouth bass fishery of notable importance last biennium has now become one dependent largely upon the much less desirable black crappie. Crappie, planted by unknown persons, began to appear in March, 1957, and by March, 1958, constituted 87 percent of all fish caught. This is a good example of the tragic results from unauthorized plants of fish.

Farm Ponds

Most of the farm ponds listed in Table 33 in the Appendix are warmwater fish ponds. Many of the ponds were stocked with fish provided by the department at no charge. Even though practically all farm ponds are closed to fishing for the general public, they relieve angler pressure on public waters.

CHANNEL CATFISH

During the biennium, for the first time, the stocking of young channel catfish became an important part of California's fisheries management program. In the past there has been a general belief that the channel catfish requires a flowing current in which to spawn and thrive, but in several Southern California reservoirs they are now reproducing naturally and putting on unusual growth. Fish weighing from 10 to 20 pounds are now being taken. At Lake Hodges and Puddingstone Reservoir, numerous small channel catfish continuously enter the catch, while trophy-sized fish add tremendous rewards to the angler. In these lakes the channel catfish is now more sought after than the largemouth bass, which formerly was considered the top trophy among warmwater fishes.

An experimental program to test the feasibility of rearing channel catfish under artificial conditions was initiated at the Central Valleys warmwater fish hatchery. Brood stock was obtained by trapping adult fish in the Sutter Bypass and Honcut Slough areas. Techniques for incubating the eggs and rearing the fry were perfected. In spite of the newness of this undertaking, with only improvised facilities, over 130,000 channel catfish fingerlings were reared.

SALTON SEA FISHERY

It took some doing and some patience, but the department's program of introducing ocean fish from the Gulf of California into Imperial Valley's 350-square-mile Salton Sea began paying handsome returns to sport fishermen during the biennium. These returns were in the form of 5- to 15-pound orangemouth corvina, the offspring of 2,189 adult corvina transplanted from 1950 through 1956.

Biologists pronounced Salton Sea's corvina ready for fishing in the early fall of 1957, when they estimated there were approximately a million of these finned fighters there for the taking. Few of the fish were caught, however, until the spring of 1958, when surf-casters tossing wobbling spoons suddenly began taking

Newly hatched catfish at Elk Grove Hatchery.
—Fish and Game Photo

Salton Sea corvina collected in gill net sample by the department.
—Fish and Game Photo

six-fish limits. As summer approached, fishing was best in somewhat deeper water, where salmon-type spoons cast from boats took hard-fighting corvina up to 15 pounds. The fish proved firm and delicious.

The Wildlife Conservation Board's three-year Salton Sea study carried out by U. C. L. A. research biologists was to end in October of 1958, but the department planned to continue regular sampling with nets to monitor this rapidly developing sport fishery. The corvina continued to spawn successfully every spring and early summer through 1958, offering the promise of even better fishing still to come.

HABITAT IMPROVEMENT

Chemical treatment to improve warmwater fisheries by eliminating unwanted fishes and replanting desirable fishes continued as an important tool for fisheries managers. Table 31 in the Appendix lists the waters treated during the biennium.

In addition to control of undesirable fishes, a number of other habitat improvement projects were undertaken to improve warmwater fisheries.

Following chemical treatment and restocking of Woodward Reservoir, Stanislaus County, 41 spawning nests were installed for channel catfish. Nests were concrete pipe sections 10 inches in diameter by three inches long, and truck tires with "windows" cut in them.

At Los Banos Waterfowl Management area, 18 brush shelters were built and installed as shelter for crappie, bluegill, and other warmwater species. Brush shelters were also installed in Atascadero Lake, San Luis Obispo County, and in Lake Havasu. These shelters cause the fish to concentrate near them, and increase angler success.

Spawning nests for largemouth bass were installed at May Pond, built in 1957 on the Mendota Waterfowl Management area. This lake now serves a dual purpose—waterfowl hunting and angling.

Following exploratory methods of cattail removal at Lost Lake, Fresno County, full-scale treatment was undertaken here to open up more fishing area. Approximately 20 acres of cattails choking this 48-acre lake were sprayed with chemicals by helicopter. Results were almost 100 percent effective, since anglers can now utilize the entire lake whereas angling was quite limited before treatment. Two lakes at Los Banos Waterfowl Management area were also sprayed by helicopter to remove cattails and provide angler access. Here again success was evident, since anglers can reach open water formerly grown over with dense cattail beds. Some 23 acres on these two lakes were sprayed with chemicals. Use of a helicopter to spray dense masses of vegetation not only made complete coverage possible but saved considerable time and expense. Whereas a two-man crew can spray up to 10 acres a day, the helicopter can do this job in half an hour, using about one-fourth the amount of chemicals.

STRIPED BASS

The striped bass and sturgeon federal aid project continued gathering information about the striped bass fishery—one of the state's most important sports fisheries—and the sturgeon fishery, which was reopened in 1954 after a 37-year closure.

During the first year of the biennium, the data gathered in the surveys of the delta commercial salmon and shad fisheries were analyzed. These surveys were made to determine the number of game fish caught and accidentally killed in the nets used in these commercial fisheries. It was estimated that 455,000 pounds of striped bass were caught in nets during the 1955 fall season and the 1956 spring season, and that 250,000 pounds of these bass were dead when removed from the nets. The department used these findings in recommending that the commercial fisheries be restricted to provide more protection for the sport fisheries.

The remainder of the biennium was spent collecting and analyzing data on the status of the bass population and the sport fishery. The general purpose of this work was to get the factual information necessary to evaluate the angling regulations which were changed in 1956, and to develop a background of statistical data

Striped bass.
—Fish and Game Photo

that can be used as a basis for evaluating future changes in the fishery.

One group of data concerns the tow net surveys that have been made annually since 1953 in an attempt to develop a technique that will provide an index of annual spawning success. The 1953-1956 surveys were carefully analyzed, and several deficiencies were discovered. The 1957 and 1958 surveys were modified to overcome some of the deficiencies, but the evaluation is continuing, since the surveys are not fully perfected. The 1957 and 1958 surveys indicated that spawning success continued to be far below what it was in 1953 and 1954.

An annual fall seining survey for juvenile stripers was initiated in 1956 to obtain an independent estimate of spawning success as part of the evaluation of the tow net surveys.

Most of the 1957-58 Fiscal Year was devoted to planning and starting a three-year striped bass tagging study. The primary purpose of this study is to estimate the proportion of the bass population that anglers harvest each year and the proportion that dies annually from natural causes. The study will also serve to supplement information about bass migrations.

The initial tagging for this study was done in April and May of 1958. A total of 4,378 bass were tagged in the delta near Antioch, and 891 were tagged in the Sacramento River at Knights Landing. A reward tag program was incorporated in the study in order to get an estimate of the number of anglers not returning tags from fish that they catch. Some preliminary results from this study will be available in the summer of 1959.

The project has also started a striped bass age and growth study to determine whether environmental changes have affected the growth rate in the last 30 years. Most of the data needed have been collected and the analysis was under way at the end of the biennium.

STURGEON

No new sturgeon investigations were started during the biennium. The sturgeon fishery continued to be of minor importance in the state, partially because no effective angling methods have been found. Most sturgeon are caught accidentally while anglers are fishing for other species.

The final results from the 1954 sturgeon tagging study were analyzed. There are two particularly significant results: 1. Only 2 percent of the tags were returned by anglers during the first year of the study, and another 0.6 percent since then; 2. One of the 994 white sturgeon tagged and three of the 25 green sturgeon tagged have been recovered in Oregon. Therefore, it is obvious that anglers harvested a very small proportion of the San Pablo Bay white sturgeon population, and that there is an interchange among the white and green sturgeon populations of California and Oregon.

Tagging a striped bass in the department's current striped bass studies.
—S. F. News Photo by Eddie Murphy

Salmon and Steelhead

This 13½-pound steelhead was taken in Battle Creek, Shasta County, by Mrs. Lewis Phillips of Claremant, Calif.
—Fish and Game Photo

Activities aimed toward maintaining salmon and steelhead consisted of surveys and investigations in connection with water developments, inventories of spawning runs, artificial propagation, construction of fish screens and ladders, removal of barriers to migrating fish, salvage of fish from drying streams and research into the factors affecting these important fishes.

Salmon continued to increase in popularity during the biennium both as a commercial food fish and as a sport fish. New boat liveries were built along the California coast where skiffs could be rented for ocean salmon sport fishing; the number of private skiffs used for salmon fishing also increased.

At the same time, the commercial ocean troll fleet grew in numbers. More and more boats now have fathometers aboard that aid fishermen in locating a particular spot known to produce fish. Many boats have automatic pilots that permit a fisherman to spend more time tending his gear than was formerly possible.

Some owners of large "trip boats" who customarily "ice down" their catch and remain on fishing grounds for days, installed brine tanks for storage of their fish. Refrigeration units keep brine at correct temperature, and pumps circulate it through the tanks. This method, pioneered in the north, produces a superior product compared to that resulting from the old icing method. In addition, from a fisherman's point of view, the brine tank method is more efficient than ice.

Total ocean landings rose to an all-time high of over one million fish in 1956. However, catch per unit-of-effort dropped slightly, indicating that such a record yield was produced primarily by increased fishing effort rather than increased abundance or availability of fish.

SPAWNER SHORTAGE

Dramatic support of this premise came to light during the winter of 1956 when it became evident that a drastic reduction had occurred in the number of salmon spawners using Central Valley streams.

Marking results indicate stocks in these streams are not only the mainstay of California's salmon fishery, but are also important contributors to fisheries north of California. Total ocean landings in 1957 dropped to about half those of 1956, or to about 600,000 fish. Again spawning escapement decreased. Tables 38 and 39 in the Appendix illustrate these trends.

Possible explanations for these decreases are numerous. For example, in the ocean, temperature, salinity, and food factors must be considered. Unusually warm coastal waters, higher in salinity than normal, did occur off the coast in 1957. These conditions are not favorable to salmon, and judging by the rather poor condition of fish landed, food was either scarce or salmon could not catch it.

Conditions inimical to salmon caused by man's population and industrial growth could have increased to a point beyond the tolerance of salmon. For example, removal of water for irrigation, industrial, and domestic use; removal of gravel from streambeds; pollution of streams by waste disposal, and mining and logging debris; blocking access to spawning areas by dams or other barriers. These man-made adversities are additional to age-old ones existing in nature.

PROGRAM PROPOSED

Efforts of the department to reorganize and bolster the salmon and steelhead investigations in an attempt to solve the perplexing problems of this critically important fishery were being made at the close of the biennium.

Responsibility for salmon historically has been divided betwen the Inland Fisheries and Marine Resources branches. The reorganization plan, as proposed by the department, placed the Marine Resources chief in overall responsibility for salmon research and operations.

Lote model fish screen which prevents salman and steelhead from straying up irrigation ditch.
—Fish and Game Photo

A research analyst heads the program, with a staff of four reporting to him and the Marine Resources chief. The proposal was presented to the State Personnel Board and the Department of Finance for approval at the end of the biennium.

Simultaneously, the department compiled a list of most urgent problems facing it as the protector of salmon. Here are the items listed, not in order of priority:

1. Determine necessary water flows for salmon and steelhead passage and spawning in all rivers, in advance of water project construction. Each water project changes a stream. Water flows must be insured and the department has to know how much to demand.

2. Develop ways to predict water temperatures that will result from water projects. Will the downstream water be suitable for salmon?

3. Continue to conduct and improve annual spawning stock inventories for all rivers. Not only must the adequacy of the stock be known, but inventories are essential in justifying fishery facilities (i.e. Nimbus Hatchery).

4. Determine optimum number of spawners for each stream. Too few fish spell disaster; too many means that the fishermen could have taken more.

5. Determine production of downstream migrant fry. Determine causes and amount of loss along freshwater migration route, during brackish water existence, and until time of entry into ocean catch (22-inch king salmon are in their second year of life). Marking experiments have indicated that only 1 percent of the fry survive to be taken by fishermen or to spawn. Of this number, fishermen landed 0.75 percent and 0.25 percent escaped to spawn. Causes of this high mortality must be found and corrected insofar as possible.

6. Determine effect on survival of variations in oceanic conditions. Recent information indicates that catches vary in relation to changes in salinity, temperature, and other factors in ocean water masses.

7. Further measure the effects of logging on salmon and steelhead habitat. More specific data would be helpful in solving this problem.

8. Test artificial spawning channels. This might be a better alternative to lost spawning areas than hatcheries—but no one has ever demonstrated their success on a large scale.

9. Test further the role of artificial propagation in salmon management. This controversial subject has never been settled to everyone's satisfaction. Is it merely an alternative to lost spawning area, or can it really add fish to the catch and at what cost?

10. Develop a better fish screen program. Determination of needs, development of types needed, priorities. Much has been done, but there is a long way to go, especially to expedite installations.

11. Develop methods of identifying stocks of salmon in the ocean. Knowledge of contributions made by each stock (Sacramento, Klamath, Eel, etc., and tributaries) is essential in assessing production.

INLAND RIVER STUDIES

The federal aid Sacramento-San Joaquin River salmon and steelhead project made good progress toward attaining its two principal goals.

The first is an evaluation of salmon and steelhead losses in the multitude of irrigation diversions, leading from streams utilized by these species as migration routes to and from the sea. There are more than 900 irrigation and industrial diversions above the Sacramento-San Joaquin River Delta, very few of which are screened to prevent fish losses. This part of the study was nearly completed during the biennium, with an overall picture of the diversion fish loss problem having been obtained. These data will lead to a more adequate screening program.

The second goal is to determine the effectiveness of supplementing natural steelhead production in the Sacramento River system with hatchery-reared fish. Facts obtained will form the basis for a sound management plan for Sacramento River steelhead. A major part of this phase of the study was also completed during the biennium.

Aside from the two principal goals, this project initiated the introduction of silver salmon into the Sacramento River system to provide more and better fishing. This phase of the program was completed during the biennium when the third and final annual plant of yearling silvers was made in Mill Creek during April 1958.

Fish Losses Evaluated

During the previous two bienniums, studies were conducted in typical diversions along the Sacramento and San Joaquin Rivers and in the Sacramento-San Joaquin River Delta. It was demonstrated on the Sacramento River that during years of normal runoff the bulk of the young fish migrate out of the upper river and into the Delta before the irrigation commences, thus accounting for a much smaller loss than might be expected. However, it was also shown that if pumps are operating when fish are migrating, the unscreened diversions do take fish—even when near-flood conditions are prevailing in the river. A change in agricultural practices, resulting in an earlier irrigation season, or installation of year-round diversion canals for transporting water to other areas of the state, could prove disastrous to salmon and steelhead resources unless adequate screens are provided.

This situation was found to be somewhat reversed on the San Joaquin River, where the diversions were found to be taking water near the peak of the seaward juvenile salmon migration and accounted for a much more serious loss of young fish.

Photo indicates trout fishing quality available in the Sacramento River during summer months. Most trout are probably young steelhead who have not yet been to sea.

—Fish and Game Photo by Dick Hallock

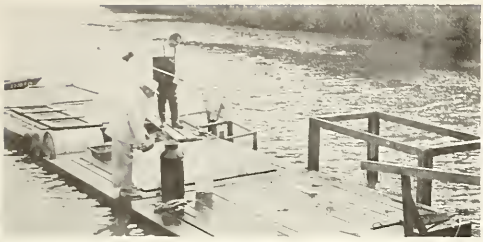
Evaluation of Steelhead Planting

With the increasing popularity of the Sacramento River as a steelhead stream, it is necessary to determine whether or not present angling regulations are adequate to assure continued excellent fishing, as well as whether or not it is economically feasible to maintain or even improve the fishing by planting yearling hatchery-reared steelhead.

To answer these questions, marked yearling hatchery-reared steelhead have been planted in the Sacramento River during each of the past six years. To evaluate the returns of marked fish from the sea, the planting is supplemented by an adult steelhead trapping and tagging program in the lower river near Knights Landing each fall and winter. Adult fish are also examined upstream from Knights Landing at the project's counting station on Mill Creek, at the U. S. Fish and Wildlife Service's Coleman Fisheries Station traps on Battle Creek, and while doing creel census work along the upper Sacramento River and tributaries.

During the biennium, 6,091 adult steelhead were trapped and examined for marks and tags near Knights Landing. Of the total trapped, 5,244 were tagged before being released. As during the previous biennium, the excellent return of tags by sportsmen has shown that anglers have continued to land an average of 30 percent of the total Sacramento River steelhead run during the past two seasons.

The steelhead planting program is being carried out in co-operation with the U. S. Fish and Wildlife Service and two sportsmen's organizations – California



Taking silver salmon at the Pudding Creek, Mendocino County, egg-taking station.

Kamloops, Inc., and Steelhead Unlimited. The steelhead are reared to yearling size at Coleman Station, where the eggs are taken from wild fish trapped in Battle Creek. The sportsmen's groups pay for the food fed to the young steelhead during the year that they spend at Coleman Station.

Planted Fish Returns

A total of 378,514 marked yearling steelhead was planted into the Sacramento River during the biennium, including 227,113 in 1957 and 151,401 in 1958. Since its inception, the project has marked and released 1,041,754 yearling steelhead.

Hatchery fish made up approximately 17 percent of the entire run of adult steelhead into the upper Sacramento River system in 1956 and 14 percent in 1957.

COASTAL STREAMS STUDIES

During the biennium, a total of 209,439 hatchery-reared steelhead was marked and released from the Cedar Creek Experimental Station, in order to provide data with which to evaluate the potentiality of hatcheries to improve runs of steelhead in the north coastal streams. The specific information which present experiments are designed to yield is:

(1) The size at which young steelhead should be released for maximum returns;
(2) Relative returns from releases made in upstream and downstream areas; and
(3) Possible differences in returns from different strains of steelhead.

The 1957 crop of steelhead totaled 63,609, which were divided into four marked groups for release. They varied in size from 7.9 to 13.9 per pound. Half of each of these size groups were released into the South Fork of the Eel River at Cedar Creek, and the other half were released at Fortuna near the mouth of the river. All of these fish were from eggs taken at the Snow Mountain egg collecting station on the main Eel River.

In 1958, a total of 145,830 steelhead was marked and released in the same manner as in 1957, except that this year two groups of steelhead from Cedar Creek stock were added. These were also distinctively marked and released to provide a test of possible differences in returns from the two strains of fish.

Returns from these releases are counted at the Benbow Dam Counting Station on the South Fork of the Eel River and at the Cedar Creek Station farther upstream. At each of these points there is a dam with a fish ladder and trap, so that all fish may be held and examined for marks before passing upstream.

Fish released so far in this study are not expected to begin returning in significant numbers until the 1959-60 season.

SILVER SALMON

The department introduced silver salmon into the Sacramento River system during the latter part of the previous biennium, when 43,025 yearlings were planted in Mill Creek in March, 1956. This was followed by plants in Mill Creek of 53,503 yearlings in 1957 and 48,800 in 1958.

Although silvers are found in streams both north and south of the Golden Gate, they were not found in the Sacramento or San Joaquin Rivers prior to the introduction. Silvers are spectacular fighters when hooked on light tackle, and now fill in a gap in the early part of the fall fishing season on the upper Sacramento.

During 1956, a total of 3,220 two-year-old silvers returned from the sea to the upper Sacramento. These were mainly small males, ranging in size between 15 and 22 inches in length. They readily took both artificial lures and bait. In 1957, the Sacramento River silver run consisted of 4,180 two-year-old fish plus 2,240 three-year-old fish. The three-year-old fish ranged between 24 and 34 inches in length and reached over 16 pounds in weight. Again, excellent silver salmon fishing was enjoyed on the upper Sacramento in 1957.

Studies on Mill Creek in the spring of 1958 showed that there was natural reproduction by silvers, since juveniles were present. Although it is too early to tell whether or not a permanent self-sustaining silver salmon population has been established, the natural reproduction by these introduced fish is a good indication of success.

Improvised ponds were installed in the ditch leading out of Crystal Lake, Shasta County. These ponds were used to test the feasibility of rearing silver salmon in water from Crystal Lake. Tests proved highly satisfactory and demonstrate the possibility for future expansion of Crystal Lake Hatchery for silver salmon propagation. To assure sufficient silver salmon eggs for carrying on the new silver salmon propagation program, an egg collecting station was established, with co-operation of sportsmen, on Pudding Creek near Fort Bragg, Mendocino County. Sufficient eggs

were obtained during this first year's operation to meet requirements.

OTHER ACTIVITIES

Considerable difficulty was encountered at the Nimbus salmon and steelhead hatchery on the American River. Water temperatures reaching a high of 66 degrees were encountered during the fall months, when the early king salmon arrived in the river. High temperatures resulted in heavy losses to fish and, in some instances, considerable loss of eggs. A plan was worked out whereby the salmon trapped at the hatchery were taken to cold water holding ponds at higher elevations and allowed to mature. Even though this poses an additional burden and expense on the hatchery's operation, it appears to be the only method of obtaining eggs from the American River salmon.

An attempt was made to develop a late-running strain of salmon, one which would arrive in the American River later in the season after temperatures became favorable. One million eggs were obtained from the United States Fish and Wildlife Service trapping facility at Keswick Dam on the Sacramento River. Fry resulting from these eggs were liberated in the river during the spring of 1958.

Screens and Ladders

An important development in the salmon and steelhead programs was the invention of a vertical, cylindrical plate fish screen with a water jet-type cleaner. This screen was developed at the Elk Grove Screen Shop, and the first working model constructed on the Granlee diversion from the Cosumnes River, Sacramento County. Preliminary evaluation indicates that it will solve some of the problems in screening very large diversion canals.

A total of 62 fish screens was maintained and operated by the department on salmon and steelhead streams during the biennium. Nine new screens were constructed and installed.

Sandblasting facilities were built at the Red Bluff and Yreka screen shops, and screen panels are now cleaned by sandblasting at the end of the season.

A major project aimed at the rehabilitation of Big Chico Creek, Butte County, as a salmon and steelhead stream got under way near the end of the biennium. In June, 1958, a Division of Forestry honor camp crew commenced the difficult task of constructing fish passage facilities around Iron Canyon Barrier, a jumble of huge boulders which have blocked migratory fish in Chico Creek since about the time of the San Francisco earthquake. The project, financed by an allocation from the Wildlife Conservation Board, will make 15 miles of spawning stream available to salmon and steelhead. Overall direction and supervision of the project was provided by the department.

A new tunnel-type fishway around the McCormick-Saeltzer Dam on Clear Creek, Shasta County, neared completion at the end of the biennium. This unique fishway is 434 feet long and is completely covered over its entire length. It was bored through solid rock most of the way. This ladder makes available an additional 25 miles of good salmon and steelhead spawning stream. The Wildlife Conservation Board financed this important work with a total allocation in excess of $60,000.

Spawning silver salmon at the Pudding Creek, Mendocino County, egg-taking station.

—Fish and Game Photo

Small fish ladders were completed on Hutton Creek, Siskiyou County, and Bolinas Creek, Marin County. Existing ladders on many other salmon and steelhead streams were maintained by regional fisheries personnel, and repairs and modifications made as needed.

A total of 21 barriers consisting of rocks, logs, or debris was removed from salmon and steelhead streams by fisheries habitat improvement crews. The streams on which this work was performed are listed in Table 32 in the Appendix.

Lagging Damage

Considerable effort has been made to acquaint the logging industry with the destruction of fish habitat which has resulted from certain logging practices. The department is also encouraging industry development of a co-operative program to institute voluntary changes in harmful logging practices.

In order to learn more specifically what environmental changes take place in northcoastal streams following logging, a systematic collection of stream bot-

A three-year-old silver salmon (12 pounds) returned from a planting in the Sacramento River near Los Molinos.
—Fish and Game Photo by Wm. Van Woert

tom organisms from streams above and below logging operations was started in the summer of 1958. The principal effort has been to locate places where clear comparisons of species and numbers of insects present in streams above and below, or before and after, logging may be made to provide both a direct measure of changes in a stream's productivity of fish food organisms, as well as possible indications of other environmental changes which would affect fish populations. This is part of the coastal streams salmon and steelhead studies, financed by federal aid.

New fish counting racks were installed on the Shasta River in Siskiyou County. Counts of salmon and steelhead were made on this river during the biennium, as well as on a number of other important spawning streams. Results from these counts are listed in Table 37 in the Appendix.

Fish Rescue

Fish rescue crews salvaged totals of 6,519 king salmon, 20,928 silver salmon, and 1,109,898 steelhead from drying streams. These salvaged fish were transplanted to waters having a permanent flow, usually in the same river system, where they could continue their natural life cycle. Nearly all of the salmon and steelhead salvage work was done in the northcoastal counties.

Size Regulations

One objective of the Pacific Marine Fisheries Commission is to develop a joint program of coastal regulations as a means of promoting better utilization of fisheries.

At the start of the biennium some Pacific coastal areas did not have ocean size limits on salmon, and there was disagreement about whether size limits were desirable. Opponents of size limits contended that released salmon suffered a high mortality; thus these fish were, in fact, being wasted. Proponents thought that even if high mortality occurred, and this had not been proved to their satisfaction, a size limit still operated as a conservation measure by forcing fishermen to avoid areas of concentrations of sublegal fish for economic reasons.

Size limit opponents countered by noting that perhaps concentrations of sublegal fish are not common, but that fish occurred in the ocean in groups of mixed sizes.

It seemed advisable to evaluate ocean salmon size limits. This evaluation was approached from two angles—determining occurrence frequency of undersized fish concentrations and determining degree of hooking mortality. Areas where concentrations of sublegal fish occurred were termed "ocean nursery areas."

During the 1957 ocean commercial season, department personnel interviewed fishermen to gather information about these problems. Interviews indicated that concentrations of undersized fish do commonly exist, and that predictions about their occurrence in time and space could be made.

Additional information was collected on hooking mortality and ocean nursery areas. Special troller reports were filled out voluntarily by fishermen and spot checks were made by department personnel who accompanied fishermen on trips as observers. Information about location and movement of undersized fish along the coast, and mortality prior to release of hooked sublegal fish was recorded in both cases. This work will give detailed and conclusive information on nursery areas and hooking mortality. It is being continued.

River Gill Nets Removed

As of September 27, 1957, the last commercial fishery for salmon in inland waters of the state ceased to exist. The Legislature passed a bill prohibiting the use of gill nets to capture salmon and shad in the Sacramento-San Joaquin Delta.

Preceding passage of the bill, which one legislator termed "the hottest of the session," were many embattled hearings pitting sportsmen against gill netters.

Throughout the discussions, the department took the position that the gill nets were the last major obstacle of the salmon on their way to the spawning grounds and recommended their removal for the reason that more spawners are needed if the resource is to be maintained. The department also recommended their removal on the grounds that nets were killing too many striped bass while fishing for salmon.

Pink Salmon

Pink salmon appeared in the ocean catch in 1957 as expected, although the reduced fishing effort, due to scarcity of king salmon, kept their number very low. The year 1955 remains as the best of the three in which these salmon have been noted in the catch, although even then they were insignficant except as oddities, making up less than one-half of 1 percent of the total landings for that year.

Department skindiving bialagists C. H. Turner, Jack Carlisle and Jerry Sexsmith prepare to check artificial reefs in the department's newest project, ocean habitat development.

—Fish and Game Photo by Jack W. Schott

Fewer vessels are participating in the sportfishing industry. The count was down to 500 during 1956 and 1957, as compared to 600 boats in 1953.

The industry shows signs of settling down to a well organized and well financed status. Some independent operators are finding that competition and costs are strong arguments for retirement. Furthermore, the need for safety regulations was recognized by the Federal Government several years ago, and as a result, Public Law 519 was enacted and put into effect June 1, 1958. This law sets safety requirements for vessels carrying six or more passengers and, as many boats cannot meet the specifications, their owners are being forced out of the sportfishing industry.

On the other hand, a number of new boats have been built, specifically for sportfishing. These boats are equipped with single or dual diesel engines, plenty of bunk space, galley service, fishfinders, and all of the latest safety devices.

In 1956, party boat fishermen accounted for more than 3¼ million fish of many species. In 1957, the total catch was 3½ million, but the composition of the catch was markedly different. Most of the difference occurred in Southern California where almost unprecedented numbers of barracuda, bonito, and yellowtail moved into range. Along the central and northern coastline, salmon made a very weak showing, the poorest since 1949. The sudden appearance of barracuda, bonito, and yellowtail in the southland appears to be a result of physical changes in oceanographic conditions, primarily increased ocean temperatures over a wide area. Their abundance gave the rockfish a chance to rest from the increasing angler pressure of the last several years.

In March, 1956, the California Fish and Game Commission increased the minimum size limit of sport-caught kelp bass from 10½ inches to 11 inches. In March, 1957, the commission again increased the minimum-size limit to 11½ inches. These increases are in line with the management plan proposed by the Department of Fish and Game and supported by ocean anglers to protect the kelp bass fishery.

Near the end of the biennium, in the area between San Clemente and Oceanside, anglers were boating from 8 to 10 kelp bass per day, two of which were legal. (The sublegal fish had to be returned to the sea.) In 1952 and 1953, a day's angling in this area yielded only two or three fish per fisherman.

The California halibut is a welcome addition to the party boat angler's bag, but is seldom the object of deliberate search. Its importance as a market fish far outweighs its importance as a game fish. Nevertheless,

the angling pressure exerted by the sportsman is felt to be an important link in the decline of the halibut, particularly since 1947.

Tagging was started in March, 1956, and approximately 8,000 halibut were tagged by the end of the biennium in California waters. Tag returns have averaged about 5 percent a year, but improved methods recently developed should increase returns substantially. Commercial fishermen have all but abandoned the fishery, with the exception of two or three trammel net operators. Trawlers catch halibut incidentally while trawling for other species.

SURF FISHES

The detailed results of the surf fishing investigation, which terminated near the end of the biennium, will appear in two biological bulletins, one on barred surfperch, the other on California corbina and spotfin and yellowfin croakers. These bulletins will cover the life histories, tagging studies, voluntary catch statistics, and a creel census analysis. The barred perch bulletin gives a considerable amount of ecological information, especially that from beach seining operations, in which about 128,000 fish of 72 species were taken during the period from February, 1953, to September, 1956. Some 7,000 fish for biological study and tagging were taken from the project species which formed part of this total. Another 4,000 specimens, including fish for tagging, were taken by trawl net and other means.

Party Boat Catches

Year	Rockfish	Salmon	Barracuda	Yellowtail
1955	2,037,000	114,500	87,500	29,000
1957	1,395,000	44,700	577,000	243,000

Barred perch made up over 73 percent of the beach seine catch of the four species; California corbina, 17.5 percent; spotfin croaker, 8 percent; and yellowfin croaker, 1½ percent.

In the surf fisherman's catch the barred surf perch predominated along the entire Southern California coast, making up virtually 100 percent of the catch north of Santa Monica Bay, and about 80 percent south of there. It was followed by California corbina, spotfin croaker, and yellowfin croaker in that order.

Marine biologists E. J. Smith, left, and Leo Pinkus, right, check size and take scale samples from unidentified sportsman's catch of barracudo. —Fish and Game Photo

No new regulations appear necessary for these four surf species at present.

YELLOWTAIL

The Dingell-Johnson Yellowtail Study was concluded in March, 1958. Prior to the start of this project, the yellowtail fishery in Southern California had steadily declined. Very little was known about this very important game fish and an extensive research program was begun in 1952 to learn the necessary biological information on which to base a sound management program. The study area included the Pacific Coast of Southern California and Baja California and part of the Gulf of California.

The results of the study show that California anglers are fishing the fringe of a yellowtail population which is centered in Baja California waters.

Good fishing in California is dependent on migration of yellowtail from Mexican waters. This was demonstrated by the large number of returns by the California sport fishery of fish tagged and released at the population center.

An extremely abundant yellowtail population exists along the central Baja California coast; the vagaries of the environment, rather than the present commercial fishery, limit the availability to California anglers. This fact was made readily apparent in 1957 when ocean temperatures off California reached their highest average in 26 years. Under these highly favorable conditions hordes of yellowtail moved north from the population center. Over 240,000 were caught from California party boats alone, this does not include the untold numbers taken from skiffs and private boats. That is three times the number caught in any previous year in the recorded history (since 1936) of party boat fishing. The year 1958 was also characterized by warmer-than-average ocean waters. Through June, 1958, about 41,000 had been taken—not so spectacular as the 1957 catch but already well above the postwar average of 30,000 per year.

Commercial yellowtail landings on the other hand remained at a very low level. The 1957 catch was 508,872 pounds compared to a postwar average of 5,350,000 pounds.

Since the yellowtail population appears healthy, there is no present need for further restrictions. However, the fishery will be kept under a limited surveillance so that any adverse changes in the present status of the population will be made known.

BARRACUDA AND WHITE SEABASS

Barracuda and white seabass are among California's most important sport fish in desirability and in numbers caught. Both species range from Magdalena Bay, Baja California to Alaska, but are most abundant from Southern California to Central Baja California where they are subject to heavy fishing pressure by commercial and recreational fishermen. White seabass are also common in some localities in the Gulf of California.

The available barracuda population has been decreasing in numbers since 1952. Catches of both the sport and commercial fisheries dropped to an all-time low of 1,100,000 pounds in 1956. The landings improved substantially in 1957, principally in the sportsman's bag, but were still far short of the 30-year average.

The white seabass fishery is apparently subject to highly variable fluctuations in abundance. Although the catches for the last 20 years trend slightly upward, anglers are taking increasing numbers of juveniles and fewer adults. The latter situation is not a healthy one, usually signaling trouble ahead.

With the increasing human population in California and the accompanying increases in fishing pressure, there is a growing need for factual assessment of the fishery conditions. A little life history work has been done on both species. However, there are insufficient data on which to base management recommendations. Therefore, early in the biennium plans were laid to initiate a study on these species.

The Barracuda-White Seabass Management Study was inaugurated April 1, 1958, as a federal aid project, with the goal of evaluating the condition of these fisheries for their maintenance at the most productive level.

The project began with compilation of data by a survey of the literature, planning and implementing a sampling program, a survey of the various phases of each fishery, and in making a preliminary catch analysis of the barracuda fishery.

The barracuda catch analysis study revealed important facts about the intrarelationships of the fishery:

1. The sport fishery takes as much as, and frequently more than, the California commercial fleet.

2. The postwar commercial fishery, from an operational point of view, was quite similar to that of the 1920's and 1930's. The season off Southern California usually begins in April and ends in August with peak landings in May and June. The Mexican fishery, composed of California vessels, is active from August to April with two peak periods of catch, September and February.

3. Perhaps the most significant factor is that each segment of the fishery reaches a climax at a different time. It is not clearly understood why the sport fishery makes its peak catches in July while the California commercial fleet makes its peak landings in May and June. Both fish are almost side by side in the same waters at the same time.

Although the sampling program was barely started in this biennium, it revealed that the 1958 barracuda fishery may be an unusual one. A relatively high early

Biologist Jack Carlisle checks construction of artificial rocks to be used in ocean habitat development project to make underwater "reefs" for sport fish.

—Fish and Game Photo

spring catch appears to be related to above-normal water temperatures.

OCEAN HABITAT DEVELOPMENT

This project, which began in April, 1958, is designed to explore the possibilities of improving sport fishing in coastal waters. The two principal means to be used are:

1. Development of artificial reefs.
2. Transplantation of kelp and development of new kelp beds.

In the short time before the end of the biennium two artificial reefs were placed along the coast. The first was a car body reef in an area devoid of fish and cover off Paradise (near Malibu) in 50 feet of water. At last check, about 150 fishes of six species had been attracted to the "reef." A second area, similarly barren of fishlife and cover, was selected off Huntington Beach. Some large artificial rocks, made of gunite for a Hollywood movie, were placed in 55 feet of water. The "rocks" weigh up to two tons apiece. Lines were tied into place for the later attachment of kelp. This "reef" had not been checked since its placement.

Observations and evaluation of results, as well as kelp transplantation, will be made by the project's biologist divers, using SCUBA (self-contained underwater breathing apparatus).

As part of the program, a study is also being made for comparative purposes of natural rocks and reefs and other habitat, as well as of shipwrecks which are the homes of great numbers of fishes. Marine life on and around offshore oil islands and platforms is also being studied to evaluate the changes occurring around manmade habitat.

Other phases of the Habitat Development Study will include a study of the possibilities of:

Predator control, especially sea urchins and starfish;

Transportation of fishes, both natives and exotics;

Obtaining fishing access to oil piers and closed beaches; and

Development of back-bays and coastal lagoons as spawning and rearing grounds.

ABALONE

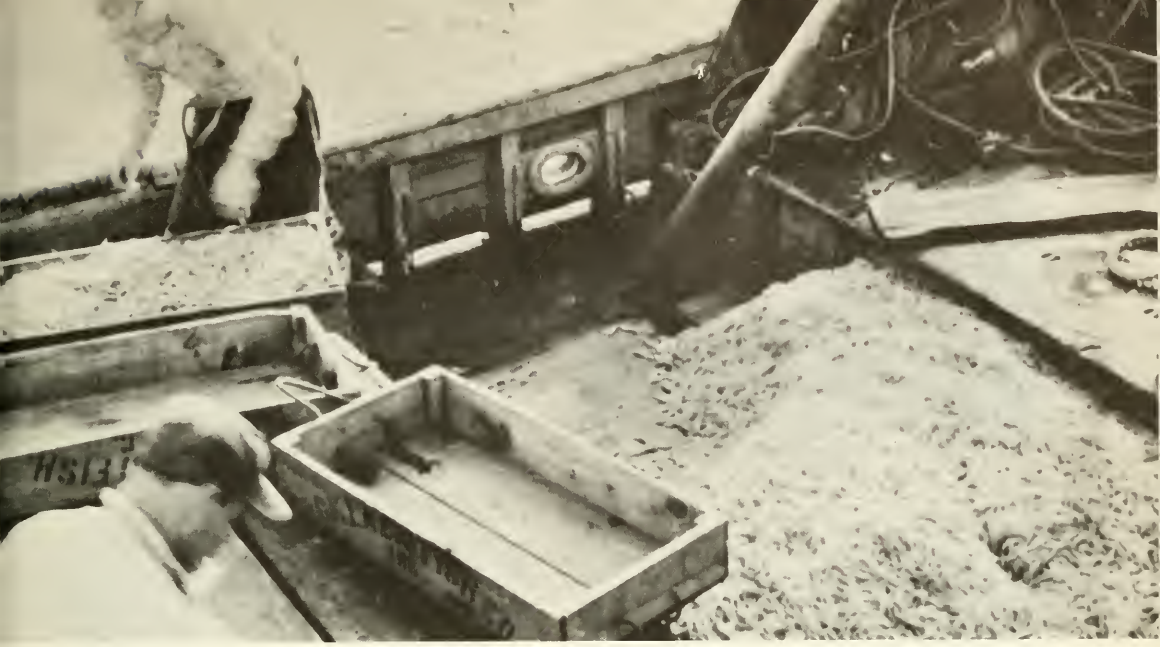
The largest catch of abalone ever landed in California in a single year was delivered in 1957 when 5.4 million pounds were taken by the commercial fishery. This is almost 750,000 pounds greater than the previous record of 4.7 million pounds taken in 1952.

In contrast to this record catch is the considerable decline of the entire fishery in the last quarter of the biennium. Principal cause appears to have been the almost complete disappearance in some areas of the kelp which provides the major portion of the food of the abalone. The disappearance of the kelp is in all probability associated with the influx of warmer water along the coast. In 1956, the department's investigation noted the lack of kelp in the abalone beds in Central California and reported at the time that future abalone catches might be affected. The intensive harvest of 1957 and the lack of an adequate food supply strongly indicate that the 1958 catch will be among the lowest since the war.

The department's investigation has revealed that the red abalone of Central California, which contributes the major portion of the statewide catch, will maintain its numbers as long as an adequate food supply

Department biologist-diver gathers abalone for tagging.

—Fish and Game Photo by Glen Bickford



Shrimp vessel unloading its catch at Crescent City.

—Photo by E. A. Best

is available and size limits are observed. As the commercial catch of the pink abalone, a southern species, has shown a decline since 1952 (with the exception of 1957) the investigation has shifted emphasis from Northern to Southern California.

Over 800 pink abalone were tagged and transplanted during the biennium and their progress is being followed. Techniques of collecting, holding, and transporting have been developed and considerable valuable knowledge is available regarding these processes.

MARKET CRAB

The crab fishery has undergone change and expansion in recent years. Contributing factors are the increased market demand for the whole and processed crab products and the evolution of highly efficient fishing gear and techniques.

The commercial harvest of the market crab reached record highs of more than 14,000,000 pounds during 1956 and 19,000,000 pounds in 1957. These landings far surpassed the previous high mark of 13,000,000 pounds set in 1952. The increased catch during the biennium may be attributed to an increase in fishing pressure and the availability on the fishing grounds of highly successful dominant year classes of marketable crabs. The harvest for 1958 appears destined to be above the average for recent years but somewhat below the record take of 1957.

Gear studies were made during the biennium to determine the optimum size for an escape opening in the crab pots that would allow a maximum number of undersized crabs to escape.

Tagging programs have supplied data concerning migrations of the market crab. Recent development of a new tagging method is expected to furnish data on growth as well as migration.

Other research activities include analysis of catch statistics and compilation of life history studies of the market crab.

OCEAN SHRIMP

California's ocean shrimp industry continues to expand with new plants and new vessels entering the fishery each year. Gains in total landings have occurred annually since 1952, despite fluctuations in local areas along the coast.

Year	*Landings*
1952	205,485
1953	287,410
1954	296,857
1955	827,733
1956	1,168,519
1957	1,376,641

Shrimp landings for 1958 totaled 706,350 pounds through June 30th—the best early production ever recorded by this fishery.

Morro Bay beds, closed in 1956 by action of the Fish and Game Commission, were resurveyed by Fish and Game personnel aboard the research vessel *Nautilus*. Shrimp were present in commercial quantities. Consequently, the commission reopened this area to fishing in 1958.

A quota system that limits annual landings of ocean shrimp, functioned for the first time in Area A (Eureka-Crescent City) during 1956 when the 1,000,000-

Marine biologist Walter Dahlstrom inspects seed oysters in Japan.

pound quota for this area was reached. During 1957, two areas were closed under the quota system. Area B-2 (Bodega Bay) was closed in July, 1957, when its quota of 400,000 pounds was reached. This area's early closure prompted the fleet to work in Area B-1 (Fort Bragg)—the first time commercial interests had attempted shrimping in this area. Its quota of 200,000 pounds was then reached by late September.

OYSTERS

California oyster production skyrocketed during 1956-57 and continued to hold strong in 1958. Oyster culture on allotted state lands and private beds yielded over 11 million pounds of Pacific oysters. Oyster allotments comprising 3,290 acres have been issued by the commission since 1955. There are now 12,700 acres designated shellfish culture areas.

A Highly Developed Fishery

Oyster culture represents one of the most highly developed marine fisheries. California oystering may be called "aquaculture," paralleling agriculture in that seed is planted, a growing crop is cultivated, protected from pests, and fattened for harvesting. Aquaculture of oysters is dependent upon a successful spawning resulting in an abundance of free swimming larvae. Then actual culturing can begin.

Unfortunately, California waters do not become warm enough for the length of time required for the development of Pacific oyster larvae. Therefore, seed production, the first step in oyster culture, is accomplished in Japan where the Pacific oyster is native. Strings of oyster shells are put in Japanese bays and larvae attach themselves to surfaces of the shells at termination of their free swimming stage. These young oysters on shells are imported as "seed" for the industry. Fortunately, the oysters transplanted to California waters enjoy an environment and an abundance of food very favorable for growth and production of full-bodied meats. Within 14 to 20 months after planting, oysters are ready for harvesting.

Landings

Year	*Pounds*
1953	161,520
1954	458,493
1955	1,635,067
1956	6,101,220
1957	11,071,422

This phenomenal growth of the industry on marine water bottoms will soon be slowed. Though California has vast areas where oysters could be produced, the Department of Public Health cannot certify many more acres as safe from contamination. Californians have relegated large portions of Humboldt, San Francisco, San Pablo, and San Diego bays to sewage disposal and until these areas are cleaned up, further growth of this industry will be hampered.

Multiple Use of Bays Sought

The department's shellfish program fosters full use of resources of all California bays. Surveys of many bays along the coast are being conducted to evaluate areas in terms of natural production along with other uses in the public interest. Oyster production is booming and the Fish and Game Commission is anxious to keep it booming, but has decreed this "gold rush" must be compatible with the production of other forms of wealth and recreation harvestable from the public domains. With the ever-increasing sport activities resulting from growth in human population it is necessary to reserve particular areas of bays for public use.

Commercial tuna fishing.

TUNA

The California tuna industry forged ahead during the biennium, attaining record production levels. Increased advertising, price cuts on some items, and favorable market conditions resulted in a larger consumption of the product.

However, the American fishermen's share of this expanding market is becoming smaller each year and prices are declining, while foreign imports continue to increase.

PACIFIC ALBACORE

Since 1950, the eastern Pacific albacore fishery has been limited almost exclusively to the ocean waters off Baja California and California. During this biennium, however, oceanographic conditions changed markedly and the fishery expanded northward. As a result, California landings included albacore caught all the way from central Baja California to northern Washington.

The year 1950 was tops for the number of boats landing albacore in California. During that year, 3,162 different vessels, not including skiffs, caught and delivered fish. Each following year many boats dropped out and near the end of the biennium only 1,404 remained in the fishery.

Log Book System Pays Off

Department scientists are making rapid progress toward an ultimate goal of improving the fishery. The new log book system, started experimentally and in a limited fashion during the last biennium, has come of age and is now standard. It is currently providing the most complete picture of the west coast albacore fishery ever compiled. It is now possible to determine where and when about 25 percent of the fish landed in California are caught and how many days of fishing effort were required to catch them.

In addition, the log books are yielding valuable information concerning the sea surface temperatures that are the most productive. They have shown that the heaviest catches of albacore were made within a relatively narrow sea surface temperature range of 60-64 degrees F. This albacore catch-temperature relationship should be of tremendous value for use in locating areas most likely to produce good fishing.

Exploratory Fishing Successful

Two albacore research cruises were conducted aboard department vessels during the last two years. These cruises were designed to intercept incoming albacore school groups prior to the start of the regular commercial fishing seasons in June and to chart their migration routes as they sweep in toward the west coast of central Baja California and Southern California. In addition, oceanographic data were obtained throughout the survey areas in an effort to correlate the apparent preference of albacore to travel along certain paths.

The results obtained from these cruises verified seasonal data obtained by log book analysis concerning the relationship between the catch of albacore and sea surface temperatures. It was also found that major coastward migrations occurred in that part of the ocean where sea surface temperatures ranged between 60 and 65 degrees F. This means that when temperature data are available it is possible to predict likely fishing areas before the season begins. Such information will be of great economic value to fishermen in the future, saving much time and expenses formerly expended by the fleet in prospecting.

CALIFORNIA BLUEFIN TUNA

The wily bluefin tuna is more suspicious of hooks than is its close relatives. Therefore, harvesting of this marine resource is accomplished by means of large purse seines. Purse seiners realize their largest catches in the coastal waters between Point Conception and southern Baja California and offshore near Guadalupe Island. Warm sea temperatures during 1957 apparently influenced their distribution and larger than usual catches were made in the northern portion of the range. In general, the fishing season begins in June and ends by October although some catches are made throughout the year in the Guadalupe Island area.

Fluctuations in demand for the product characterize the bluefin fishery in general, although catches tend to be sporadic even with a steady demand. In spite of this instability, landings reached high levels during the last two years.

Attention was focused on the bluefin problem early in the biennium and plans made to increase research returns on this species. As a result, basic catch data concerning 80 percent of the total landings have been obtained and there is now the most complete picture of the West Coast bluefin fishery ever compiled.

With this information gathered, an understanding of the erratic catches should place the fishery on a more stable yield basis.

PACIFIC YELLOWFIN TUNA AND SKIPJACK

These "tunas" prefer more tropical climes than do albacore or bluefin tuna and are harvested the year around in the tropical eastern Pacific by large California-based tuna clippers capable of ranging far afield. During the previous biennium these fishing vessels operated offshore from southern Baja California south to Peru, including the outlying banks and islands. During the present biennium, however, some commercial vessels cruised several hundred miles farther south into inhospitable waters off the coast of Chile, while others fished all year off Baja California. The Chilean

Skipjack tagged with "spaghetti" type tag.

—Fish and Game Photo

authorities did not approve of California fishermen operating near Chile and welcomed some of them with machinegun fire.

Tagging Discloses Migration Mysteries

Eleven department tagging teams, each composed of two men, went to sea aboard commercial tuna clippers and were successful in affixing tags to many thousands of yellowfin tuna and skipjack. Some teams remained at sea up to four months during a single cruise and all worked over 14 hours per day in their efforts to obtain additional oceanographic and biological data that should eventually lead to a better understanding of the habits of these species and thus improve the fishery.

Tags returned to the Department of Fish and Game State Fisheries Laboratory at Terminal Island from these and other cruises have provided valuable information concerning yellowfin tuna movements. They have revealed that fish tagged in the Gulf of Panama have moved northward into waters off Costa Rica. Yellowfin tagged off the coast of El Salvador have traversed the stormy Gulf of Tehuantepec and entered the fishery off central Mexico. Those tagged off central Mexico traveled northward into the Gulf of California, into the fishing grounds off southern Baja California, and offshore to the Revilla Gigedo Islands. Yellowfin tagged near these islands have entered the southern Baja California fishery.

These data indicate that there is a relationship between the Central American stocks and those off Baja California. The extent or magnitude of this relationship is yet to be determined.

There is no doubt that these fish are capable of covering tremendous distances during their lifetime. The pattern of these movements is beginning to take form and, when fully understood, will enable fishermen to fish more economically.

Size Composition of the Catch

The size composition of the catches made by tuna clippers landing their fish at Terminal Island is sampled by department personnel on a routine basis. These data explain the various long-term fluctuations in the fishery. In the past, lack of manpower made it impossible to obtain maximum results from this information. During the biennium, however, a significant step forward was made toward the solution of this problem. As a result of reorganization, the biostatistical section has been able to undertake processing of several years of past size frequency information. This increase in efficiency will result in more rapid analysis and timely publication of results.

SARDINES

Sardine landings were poorer than they were during the preceding two years. The 1956-57 canning season accounted for 33,000 tons and 21,000 tons were processed in 1957-58.

In Southern California, fishing was carried on from October 1, 1956, through February 1, 1957. The season started promptly at Port Hueneme where a small fleet delivered to trucks which hauled most of the fish to canneries in Central California. The Los Angeles fleet could not agree upon a price so did not start fishing until October 8 when a settlement was reached at $47.50 per ton.

In 1957-58 Southern California season was changed by the State Legislature from October 11-February 1 to September 1-December 31. Fishing again started promptly at Port Hueneme, for $52.50 a ton, but a price and labor dispute in the Los Angeles area tied up most of the fleet until the night of November 10. The final price agreed upon was $55 per ton. Sardines were quite abundant in the Hueneme area in 1956-57 and boats did well at the beginning of the season. In 1957-58 fish were much less abundant and the fleet turned to mackerel fishing early in the season.

There were practically no fish taken in Central California during either season.

A fleet of 160 boats operated during the 1956-57 season, a drop of 20 from the preceding year. This

fleet consisted of 98 large boats (over 60 feet) and 62 small. In 1957-58, the fleet was further reduced to 132 boats, 76 large and 56 small.

Since its inception, the live bait sampling program has been used as a means of evaluating the relative strength of incoming year classes of sardines. Until 1957, the largest percentage of "firecracker" fish of the year recorded in the live bait catch was 0.3 percent of the total "scoops" taken. In 1957, a tremendous influx of young fish was observed. Based on preliminary figures, it seems likely that the 1957 year class of sardines contributed as much as 6 percent to the total live bait catch. Biological and oceanographic data obtained by member agencies of the California Co-operative Oceanic Fisheries Investigations substantiate these findings and indicate that 1957 contributed a strong year class of sardines.

MACKEREL

Commercial landings of Pacific mackerel during the 1956-57 season were 28,000 tons, a 100 percent increase over the previous season, while jack mackerel landings totaled 48,000 tons, an increase of 30 percent. During the 1957-58 season, landings of Pacifics were 28,000 tons, the same as the previous year, while jacks declined 62.5 percent to 18,000 tons.

In 1956-57 about one-third of the season's catch was landed in October and November while in 1957-58 about one-half of the entire catch was landed during the same two months.

Of those vessels fishing mackerel in 1956-57, 160 boats used roundhaul nets and 50 were scoop boats. In 1957-58, there were 147 boats using roundhaul nets and 132 using scoop nets. Because of poor sardine fishing, larger boats are becoming fewer while smaller boats, which are cheaper to operate and require less division of profits are increasing in number.

The 1955 year class of Pacific mackerel comprised 60 percent of the 1956-57 catch with 1953 and 1954 contributing about equal amounts to the remainder. These three year classes dominate the 1957-58 catch also, with the 1955 class again contributing the largest amount. Neither the 1956 nor 1957 year class has contributed enough to the catch to be considered significant.

Prices during the 1956-57 season were $45 per ton for Pacifics and $42.50 for jacks, until January 4, 1957, when $42.50 was paid for both. In 1957-58 the price for species varied from $40 per ton to $55 per ton.

ANCHOVIES

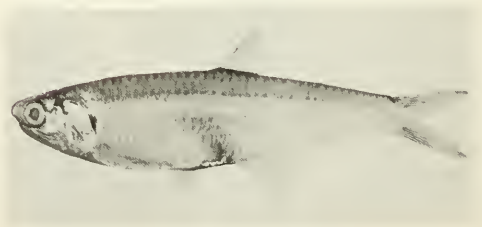
Commercial landings of anchovies for the year 1956 were 28,390 tons. Although the 35,000-ton quota then in effect was not reached, this tonnage was the largest landed by California boats since 1953 when 42,252 tons were taken. Eighty-one percent of the 1956 catch was landed in the Los Angeles area. During the good year of 1953, 75 percent of the fish taken was credited to central California ports.

The 1957 Legislature did not renew the quota, and by late spring of that year market demands were good, approximately 12,500 tons being landed during the first six months. This figure was almost 2,000 tons more than that recorded during the same period in 1956. However, due to an almost total failure in the central California area, the 1957 season ended with a total catch which was the smallest in six years—20,259 tons, 95 percent of which was credited to the Los Angeles area.

Sampling of the catch from the two major fishing areas, Central and Southern California, indicated that two-year-old fish contributed well over half the numbers of fish caught. Of the incoming year classes, the 1956 group did not appear to be outstanding in either area, but the 1955 appeared to be strong in Southern California. Information obtained through live bait sampling, aerial scouting, and commercial fishing records indicates that the 1957 and 1958 year classes are good. Data from the above sources show that heavy concentrations of "pinhead" fish-of-the-year and one-year-olds are present along most of the coast, particularly in the Central California region.

Analysis of plankton samples taken in May, 1958, by the California Co-operative Oceanic Fisheries Investigations shows that heavy anchovy spawning took place between Point Conception and Monterey. Larvae were widely distributed between Point Conception and Dana Point, some being taken as far as 200 miles offshore. Larvae were abundant throughout an area where bait and commercial fishermen have had no success in obtaining adult anchovies. Perhaps these larger adults have been unavailable because of an offshore movement into deeper, colder water. This theory was substantiated earlier in the year when purse seine-caught bluefin tuna taken between San Clemente Island and Santa Catalina Island were found to be gorged with five- and six-inch anchovies. Samples from the live bait catch show that two-year-old and older anchovies were plentiful during 1956 and 1957, but are rare in the 1958 catch. Fish-of-the-year did not appear

Deep-bodied anchovy.
—Photo by Al Johns, San Pedro



Tagging halibut.
—Fish and Game Photo

in any quantity during 1956 but were plentiful during the latter part of 1957 and have been abundant in 1958.

New aerial survey techniques were developed during the biennium and the program was intensified. A method for determining the aerial magnitude of pelagic fish schools was worked out, photographic experiments were attempted and an effort was made to use surface vessels in conjunction with the airplane. Flights during 1956 revealed only moderate concentrations of anchovy schools most of which were observed in Southern California and Baja California. Results of 1957 flights showed an increase of school groups in Central California late in the year, while Southern California and Baja California remained about the same as 1956. Counts of anchovy schools resulting from aerial surveys during the first half of 1958 indicate that a very large population is present off Central California. Many thousands of schools were observed from San Francisco to, and into, Monterey Bay. Localities south of this area also contained fair to good concentrations of fish.

Even though anchovies appear to be abundant, the 1958 commercial season through June was not good. The prospect for coming years is good as long as this large population of young fish survives and becomes available to the fishermen.

BOTTOM FISHERIES

California's otter trawl fleet continued to produce more than 30 million pounds per year of assorted fishes for use by local markets in a fresh and fresh frozen state. Foreign imports increased and became a deterrent to continued high production. "Tight" markets characterized the latter months of the biennium. Most markets placed strict limits on species and poundages delivered by their vessels.

Dover sole continued to be the leading species taken by the trawl fleet with over seven million pounds per year landed in 1956 and 1957. Bocaccio landings increased again and may exceed those of dover sole in the near future.

The animal food industry expanded with an addition of one plant. This industry now utilizes about 3 million pounds of whole fish that in former years were considered unsalable and discarded at sea. Market leftovers of fish frames and viscera are the major source of raw material for these plants. About 8 million pounds of frames are used annually.

Sampling of trawl catches, both at sea and in markets, was carried out at Eureka, Fort Bragg, and Morro Bay. In the northern part of the state fishing emphasis is on flat fishes; southern ports land more rockfishes. A program of sampling animal food landings for species and size composition was initiated this biennium. A continuing long-term analysis of trawl vessel log books enables the department to keep abreast of new developments within the fishery.

Catch of rockfish, mainly bococcio and chilipepper, about to spill on the deck of the otter trawler "Franklin." A pull on a slip-knot in a purse line opens the end of the net. This catch was made at a depth of 110 fathoms about five miles off San Simeon.
—Fish and Game Photo by J. B. Phillips

Unsorted catch of rockfish, mainly bocaccio and chilipepper, made by hauling an otter trawl (drag net) on the bottom at a depth of 110 fathoms, six miles offshare between Cambria and San Simeon.
—Fish and Game Photo by J. B. Phillips

ROCKFISH

The commercial catch of rockfishes or "rock cods" in California waters has shown a fairly steady increase from six million pounds in 1949 to a high of 16 million pounds in 1957.

The port of Monterey continues to lead other California ports in the amount of rockfishes landed each year. Landings at Morro Bay have increased in recent years and this port now ranks next to Monterey in quantity of rockfish landed. San Francisco is third, followed by the Northern California ports of Fields Landing, Eureka, and Fort Bragg. Commercial landings of rockfishes at Southern California ports are not of great importance.

The greater portion of the total catch of rockfishes landed is by otter trawls (drag nets). Hook-and-line gear (longlines) account for the rest of the catch. Most rockfishes landed at wholesale fish markets are filleted and marketed fresh or frozen.

The species of rockfish which appear in greatest abundance in commercial catches are bocaccio, chilipepper, canary rockfish, vermilion rockfish, yellowtail rockfish, olive rockfish, widow rockfish, and black rockfish. A number of other species appear in lesser quantity. Several species are too small, even when fully grown, to be of commercial value, but they do form part of the diet of larger fish.

Life history studies have been started on the more important rockfishes. Information on the size at maturity, rate of growth, and spawning periods are facts that need be considered in a management program.

NORTHERN CALIFORNIA SPORTFISH

On July 1, 1957, Federal Aid Project F-12-R-3, Ocean Salmon Study, was amended to assume new objectives. This project is now designed to assess the marine fishing population from Point Conception to Oregon and determine the kinds, size and number of fish being caught by each method.

Similar projects have been and are now being undertaken on the east coast, but this is the first to be set up along the Pacific Coast. The Pacific Coast is unique in having very large centers of population near the coast interspersed with sparsely populated areas. In fact, large sections of the study area are inaccessible due to lack of roads and trails.

The first six months were spent in exploratory field work. Surveys were made to locate areas being used by fishermen, and biweekly trips were made over the entire area to count fishermen and record the species caught. During this period basic data were collected to determine the methods that must be used to solve the project's objectives.

The vast area encompassed by the project and limited manpower precluded any attempt to gather simultaneously data toward the solution of all objectives over the entire area. As the department has an efficient system of recording the effort and general catch of the party boat fleet, project personnel were

Surf fisherman on the Sanoma coast.
—Fish and Game Photo

able to concentrate on sampling the party boat catch for specific breakdown of the catch. The skiff, pier, shore casting, surf netting, and skindiving methods likewise will be assessed by the project.

Since February, 1958, the biweekly coastal coverage has evolved into a sampling procedure involving turnover rate of fishermen determinations, obtaining interview data from fishermen, sampling the catch of those who completed fishing at these turnover localities, aerial counts from state-owned airplanes, and establishment of a volunteer log system for skiff rental and launching concessions, private shorelines and state parks.

SPECIAL ACTIVITIES

During the biennium the biostatistical unit was reorganized to facilitate closer working relationships with the biological investigations. The reorganization included the establishment of a technical assistance and biometrical analysis section. This section assists in the analysis of existent biological data and in the design of data collection and sampling methods compatible with statistical evaluation.

Tabulation of regular commercial catch reports was continued. This information provides the basis for publications and is used to answer requests from the Legislature, the commission, and the public. Such data are indispensable for the management of marine resources.

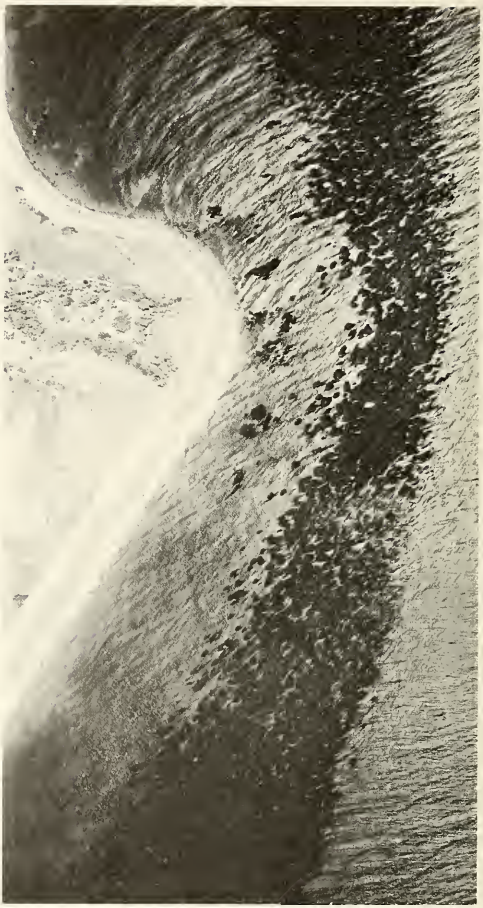
Other departmental needs for tabulated reports were fulfilled as requested. Angling questionnaires for both inland and ocean fishing were tabulated. Striped bass logs, Lake Merced post card questionnaires, and departmental training records were among scheduled reports.

Requests for figures have been fulfilled for international agencies such as the International North Pacific Fisheries Commission, International Pacific Halibut Commission, and the Inter-American Tropical Tuna Commission. The United States Fish and Wildlife Service continued to make use of our records for their biological investigations and for its fisheries market news section.

Processing procedures for marine sport catch records were modified to make greater use of the accounting machines. Preparation and distribution of the monthly party boat sport catch letter was incorporated into the program of the biostatistical unit. With assistance from the sport fish investigation, these summary figures were in the hands of the sportsmen, party boat operators, and interested individuals about 30 days after the end of each month.

PUBLICATIONS

The staff issued four publications during the biennium. Statistical Circulars 31 and 32 presented the annual statistics of fresh and canned fishery products for the years 1956 and 1957.



Aeriol photos of kelp bed off El Copiton Paint, Santa Barbara County, token three yeors oport. In Moy, 1955, the kelp bed grew solidly oround the paint os shown in above photo token at 7,200 feet elevotion . . .

Fish Bulletin No. 104, entitled "A Review of the Rockfishes of California (family *Scorpaenidae*)," presented the first comprehensive report in history on the 52 members of this fish family that are known to inhabit the ocean off California. Each of the 52 kinds was illustrated and detailed information was given on measurements and other means used in distinguishing them from each other.

Fish Bulletin No. 105 included the complete commercial fishing catch landed in California as well as all fish shipments that were processed in California. This record covered the years 1955 and 1956. "Rockfish Review" by J. B. Phillips, was the article included in

. . . warm water of 1957 and 1958 thinned most kelp beds south of Pt. Conception. This is well illustrated in the 1958 photo, above, of El Capiton Point taken at 10,800 feet elevation. Note the track of the kelp cutter through the center of the bed.

—Fish and Game Photo

this year's bulletin. The primary difference between bulletin and circular figures is that the circular records final case pack, processor records, and preliminary landing figures, while the bulletin presents final landings and the value of these landings for all California ports.

KELP

In 1955, the California Fish and Game Commission formed a standing committee that is now known as the Kelp Study Committee. This group has been instrumental in establishing co-operative working agreements between members of the kelp and sportfishing industries. Perhaps more important, the Department of Fish and Game, acting on the recommendation of the Kelp Committee, has set up a five-year kelp study program with the University of California. The researchers doing this work are headquartered at Scripps Institution of Oceanography, La Jolla.

Two years of research by this team of investigators have produced some important answers in the field of kelp physiology and ecology. A third phase of the work, now about one year old, is aimed at discovering some of the more important relationships between the kelp plant and its attendant fishlife.

In May, 1958, a series of aerial photographs was taken of the coastal kelp beds between the Mexican boundary and Pt. Arguello. Comparisons of these photos with similar photos taken during the last biennium showed some changes in the densities of many of the more southerly beds. These changes were especially apparent with respect to thinning during the past two years. This thinning is thought to be, for the most part, a result of extensive warm water conditions during the last 16 to 18 months of the biennium.

SPECIAL PROJECTS

With the start of the year 1958 new positions were established at the Stanford and Terminal Island offices. The object was to designate one biologist at each location to be available for such jobs as did not fall into the pattern of the organization as now set up. These unscheduled and often pressing items frequently interrupted the work of the men assigned to the larger and longer term studies.

One of the jobs done by the special project men included collection of shellfish samples for analysis of gonyaulax poison. Due to exceptionally warm ocean temperatures in the fall of 1957 there was a prevalence of red water along the whole Pacific Coast. During the summer such occurrences are not remarkable but this year it continued in a lesser degree on through the winter. Even bay dwelling clams picked up appreciable amounts of poison. However, no concentrations were found that required a quarantine.

Another special project consisted of a trip at the importer's expense to New York State to inspect a shipment of oysters destined for California waters. The possibility of having the oysters disqualified for planting after arrival more than offset the importer's trouble and expense of sending a biologist clear across the country.

A project involving the disposal of radioactive waste was also completed. One method of getting rid of waste from industries working on fissionable materials is to sink the material in the deeper parts of the ocean. A series of sample containers was made and taken to an area off the Farallone Islands. Here they were lowered from the vessel *N. B. Scofield* to determine their resistance to the tremendous pressures of deep

The "Alaska," newest member of the department's research fleet.
—Fish and Game Photo

water. From the information gained, recommendations can be made to the disposal agencies which will help reduce the contamination of marine life by radioactive wastes.

RESEARCH VESSELS

Yellowfin

In May, 1956, extensive dry rot was found throughout the *Yellowfin*, rendering the vessel unsafe for further biological work. It was stripped of all salvageable research equipment and in February, 1957, was sold for a high bid of $55,555.55.

Alaska

In the summer of 1957 the department negotiated a 10-year loan agreement with the U. S. Fish and Wildlife Service for the use of the *M/V Alaska*. The *Alaska* had been decommissioned by the USFWS in 1953 at Brunswick, Georgia. It was reconditioned and outfitted in Miami, Florida. After a shakedown cruise the vessel arrived at San Pedro, her home port, February 12, 1958.

The *Alaska* is a West Coast purse-seine type vessel of steel construction. She is 100 feet long with a cruising range of 7,500 miles, and has accommodations for 10 crewmen and seven scientists. Fishing platforms, three large bait wells, a large freezing compartment, trawl winch and davits, a blanket net, two large A.C. generating plants, a sea scanar, ship-to-shore radiotelephone, radar, and two fathometers make the *Alaska* well suited for all of the department's major investigations.

The *Alaska* was constructed in 1947 at Long Beach, California, and first used in fisheries exploratory work around Pacific islands but later modified and equipped for oceanographic work in the Gulf of Mexico and Caribbean Sea.

During the biennium, the *Alaska* completed three cruises in 61 operating days. Two of these cruises were made to carry out pelagic fish investigations and were conducted in the waters of Southern California.

The third cruise was made in an effort to determine the migration route of albacore as they approach the Pacific Coast prior to the commercial fishing season.

N. B. Scofield

The *N. B. Scofield* completed 19 cruises during the biennium in 363 days of operation. Thirteen of these cruises were made to carry out pelagic fish investigations on the commercially important sardines, anchovies, and mackerels. For the most part these investigations were made in coastal waters of California and Baja California between San Francisco and Magdalena Bay. On several of these cruises experiments were made with electrofishing devices.

Three trips were made into offshore waters of Baja California and Southern California to determine albacore migratory routes.

Three trips utilized trawl gear—two to carry out exploratory work on shrimp off Southern and Northern California, and one to investigate crab populations in Northern California waters. Two of the trips were of 45 days duration.

Mollusk

The 26-foot diving boat *Mollusk* is designed for working close to rocks in shallow water where it can operate in areas which would result in the destruction of less maneuverable craft. The boat has been used exclusively in the abalone investigation. Equipped with compressor, diving stage and ladder, deep sea diving equipment, hose, and underwater telephone, it enables department personnel to work in comparative safety while conducting underwater surveys and operations.

Nautilus

The *Nautilus* continued its primary function, that of mother ship, and base of operations for the abalone investigation. Because the *Mollusk* is small and has no accommodations to sleep or feed the necessary crew, the 50-foot *Nautilus* goes along whenever the investigation is so far from the port that it is not practical to return to harbor each evening.

In addition to being equipped to carry out the abalone investigation, the *Nautilus* is well-rigged for other work.

During the biennium the vessel operated 338 days, 225 of which were to carry out abalone investigation. The balance was exploratory work and was evenly divided between shrimp and crab.

In the spring of 1958 the *Nautilus* underwent a major overhaul that included replacement of its main engine.

Appendices

Waterfowl on the Sacramento National Refuge.

—Fish and Game Photo

TABLE 1

FISH AND GAME PRESERVATION FUND

SUMMARY OF REVENUES, EXPENDITURES, AND SURPLUS

	56-57 Fiscal Year	57-58 Fiscal Year
Total state revenue—all sources	$7,713,199	$8,742,533
Total expenditures	9,029,409	9,464,889
Subdivision of expenditures:		
Salaries and wages	4,533,738	4,917,634
Number of positions:		
Support (includes Marine Research Committee)		
Filled	(837.3)	(854.7)
Gross authorized	(905.5)	(881.9)
Federal aid		
Filled	(116)	(129.2)
Gross authorized	(130.5)	(133.1)
Operating expense	3,084,580	3,117,918
Equipment	365,608	260,663
Less reimbursements	—338,101	—384,348
Subdivision of expenditures—Continued		
State Employee's Retirement (includes P. R. and D. J.)	$467,390	$535,719
Pittman-Robertson (state funds)	231,729	271,897
Dingell-Johnson (state funds)	72,271	78,212
Board of Control claims	1,717	1,031
Capital Outlay	460,617	447,202
Pacific Marine Fisheries Commission	17,600	17,900
Studies and Investigation of Kelp Beds	30,000	50,000
Studies of Pollution of the Sacramento River	5,067	2,828
Joint Legislative Study		20,549
Marine Research Committee	97,193	127,684
Prior year adjustments to surplus	+2,183	+2,440
Accumulated surplus—June 30	3,516,223	2,796,307
Operating deficit (includes prior year adjustments)	—1,314,027	—722,356

TABLE 2

FISH AND GAME PRESERVATION FUND

STATEMENT OF REVENUE

	56-57 Fiscal Year	57-58 Fiscal Year
Department of Fish and Game, License Sales		
Angling	$4,147,237	$4,098,857
Commercial hunting club	975	1,125
Commercial hunting club operator	350	410
Deer tags	452,873	425,233
Fish breeder	5,490	4,815
Fish importer	365	115
Fish canners and processors	4,500	4,125
Wholesale fish dealers and preservers	8,978	9,150
Fish tags	8,544	22,231
Fishing party boat permit	1,968	1,767
Boat registrations	42,060	39,680
Salmon tags	171	105
Game breeders	10,905	9,970
Game bird club license	9,600	10,700
Game bird club tags	3,181	4,166
Game tags	1,854	1,875
Migratory game bird feeding	555	470
Hunting	1,938,141	1,870,216
Kelp harvesters	30	30
Commercial fishermen	97,174	115,677
Trapping	860	827
Guide licenses	2,170	1,950
Deer meat permits—locker plants	12,876	8,491
Deer meat permits—wardens	3,157	1,996
Controlled hunting area permits	93,304	104,730
Pheasant tags	231,167	425,110
Special big game hunts	19,180	28,230
Bass tags	21	
Napa marsh permits	1,447	1,775
Colorado River permits	10,962	13,220
Perch tags	833	923
Abalone boat registration	3,960	960
Shellfish cultivators	250	275
Live freshwater bait fish	2,600	2,140
Nutria breeders	8,525	8,425
Pheasant and coot permits	38	
Bird net tags	2	10
Bird net permits	20	160
Bear tags		19,914
Department of Fish and Game, License Sales—Continued		
Scientific collector's permit		$1,060
Falconry		495
License stamps		1,095,849
Catfish tags		1,928
Coturnix tags		65
Inyo-Mono possession tags		5,825
Totals, license sales	$7,126,323	$8,345,105
Less:		
Commissions retained by agents selling licenses	—341,666	—333,705
Net revenue from license sales	6,784,657	8,011,400
Court fines	164,520	175,786
Taxes:		
Fish packers and fish dealers tax	350,997	301,126
Salmon tax	59,920	29,743
Kelp harvester tax	5,549	3,841
Oyster tax	1,335	1,627
Miscellaneous revenue	107,078	46,397
Total	$7,474,056	$8,569,920
Marine Research Committee, Taxes:		
Sardine	33,303	21,751
Mackerel	76,119	48,418
Anchovies	26,260	7,899
Herring	749	1,157
Squid	9,501	7,000
Total, Marine Research Committee	$145,932	$86,225
Total revenue exluding interest on investments	$7,619,988	$8,656,145
Interest on investments	93,211	86,388
Total revenue	$7,713,199	$8,742,533

TABLE 3

FISH AND GAME PRESERVATION FUND

	1956-57 FISCAL YEAR EXPENDITURES			1957-58 FISCAL YEAR EXPENDITURES		
	State	Federal aid	Total state and federal	State	Federal aid	Total state and federal
Wildlife Protection	$2,647,724		$2,647,724	$2,789,316		$2,789,316
Inland Fisheries	2,161,739		2,161,739	2,138,719		2,138,719
Game Management	1,346,477		1,346,477	1,181,795		1,181,795
Federal aid-research and development:						
Game	242,043	$726,116	968,159	284,680	$854,040	1,138,720
Inland Fisheries	60,626	181,878	242,504	63,817	191,453	255,270
Marine Resources	15,347	46,040	61,387	18,401	55,201	73,602
Total-federal aid	$318,016	$954,034	$1,272,050	$366,898	$1,100,694	$1,467,592
Marine Resources[1] and[2]	[1]1,001,048		[1]1,001,048	[2]1,003,202		[2]1,003,202
Regional management	453,855		453,855	547,653		547,653
Administrative services	385,039		385,039	440,147		440,147
Staff management services	328,853		328,853	588,067		588,067
Fixed charges:						
General administrative charges	103,383		103,383	117,365		117,365
Attorney general services	19,038		19,038	21,015		21,015
Legislative study				20,549		20,549
Total fixed charges	122,421		122,421	158,929		158,929
Conservation Education Commission	221,338 43,098		221,338 43,098	206,576 43,587		206,576 43,587
Totals	$9,029,408	$954,034	$9,983,442	$9,464,889	$1,100,694	$10,565,583

[1] Includes Marine Research Expenditures for $37,673 and Pacific Marine Fisheries Commission of $17,600.
[2] Includes Marine Research Expenditures for $127,998 and Pacific Marine Fisheries Commission of $17,900.

TABLE 4

WILDLIFE CONSERVATION BOARD
1956-57 FISCAL YEAR EXPENDITURES

Support		
Salary and wages	$40,301	
Operating expenses	23,866	
Equipment	1,148	
		$65,315
Contribution to Retirement System		3,034
Total Support		$68,349
Capital Outlay Projects		
Fish hatchery and stocking		$95,027
Warmwater and other fish projects		282,804
Flow maintenance and stream improvement		39,976
Fish screen and ladder		34,401
Waterfowl		340,945
General		7,327
Special		10,218
Total Capital Outlay		$810,698
TOTAL EXPENDITURES		$879,047

TABLE 5

WILDLIFE CONSERVATION BOARD
1957-58 FISCAL YEAR EXPENDITURES

Support		
Salary and wages	$40,678	
Operating expenses	23,053	
		$63,821
Contributions to Retirement System		4,118
Total Support		$67,939
Capital Outlay Projects		
Fish hatchery and stocking projects		$46,021
Warmwater and other fish projects		61,871
Flow maintenance and stream improvement		50,564
Fish screen and ladder		11,541
Waterfowl		154,631
General		159,339
Special		—2,138
Total Capital Outlay		$481,829
TOTAL EXPENDITURES		$549,768

TABLE 6

(Wildlife Protection)
ARRESTS AND FINES

	1956-57	1957-58	Total
Doves and pigeons	137	146	283
Upland game	50	156	206
Deer	926	832	1,758
Public shooting area trespass	403	271	674
Loaded gun in vehicle	1,511	1,547	3,058
Hunt without license	191	268	459
Pheasants	364	636	1,000
Waterfowl	382	475	857
Bears		10	10
Inland fish	2,545	2,362	4,907
Clams and shellfish	989	827	1,816
Commercial fish	321	335	656
Angling without license	2,374	3,409	5,783
Pollution	25	31	56
Stream obstruction	3	9	12
Angling without license stamps		85	85
Miscellaneous	973	1,140	2,113
Total cases	11,194	12,539	23,733
Fines	$318,461.50	$378,269.00	$696,730.50
Sentences suspended	248	273	521
Juvenile cases handled	25	69	94
Placed on probation	241	358	599
Not guilty verdicts	50	35	85
Cases dismissed	50	96	146
Jail sentences—days	5,650	5,180	10,830

TABLE 7

HUNTING LICENSE SALES

Year	Number licenses	Year	Number licenses
1907-08	113,975	1933-34	171,139
1908-09	111,911	1934-35	174,667
1909-10	124,421	1935-36	190,257
1910-11	138,669	1936-37	225,448
1911-12	141,777	1937-38	248,365
1912-13	159,762	1938-39	252,117
1913-14	159,164	1939-40	270,095
1914-15	161,402	1940-41	291,507
1915-16	155,522	1941-42	331,878
1916-17	166,372	1942-43	268,128
1917-18	No record	1943-44	284,370
1918-19	No record	1944-45	318,910
1919-20	No record	1945-46	393,282
1920-21	225,454	1946-47	487,307
1921-22	222,791	1947-48	507,552
1922-23	226,381	1948-49	504,173
1923-24	246,299	1949-50	496,735
1924-25	226,421	1950-51	491,424
1925-26	231,305	1951-52	534,684
1926-27	253,532	1952-53	588,764
1927-28	257,738	1953-54	613,928
1928*	228,696	1954-55	620,587
1929	241,709	1955-56	634,136
1930	231,970	1956-57	668,165
1931	214,577	1957-58‡	647,200
1932-33†	154,031		

* Fee increased from $1 to $2.
† Licenses on 18-month period. Fee increased 50 percent for period.
‡ Estimated.

TABLE 8

SPORT FISHING LICENSE SALES

Year	Number sold	Year	Number sold
1914	81,965	1936	300,611
1915	87,262	1937	326,745
1916	111,994	1938	348,227
1917	No record	1939	366,452
1918	No record	1940	390,342
1919	No record	1941	460,715
1920	No record	1942	433,431
1921	176,873	1943	447,352
1922	183,116	1944	436,940
1923	225,171	1945	557,536
1924	202,690	1946	768,816
1925	222,983	1947	884,747
1926	246,167	1948†	960,146
1927	262,886	1949	992,519
1928*	217,788	1950	983,019
1929	225,774	1951	1,015,469
1930	248,319	1952	1,098,597
1931	242,857	1953	1,187,328
1932	212,662	1954	1,240,060
1933	175,936	1955	1,303,096
1934	211,190	1956	1,380,864
1935	224,661	1957‡	1,433,800

* Fee increased from $1 to $2.
† Fee incressed from $2 to $3.
‡ Estimated.

TABLE 9

DEER TAG SALES

Year	Number sold	Year	Number sold
1927	110,760	1943	147,795
1928	105,638	1944	178,250
1929	115,472	1945	214,662
1930	123,999	1946	282,060
1931	129,005	1947	299,610
1932	96,702	1948	300,405
1933	95,776	1949	309,829
1934	108,923	1950	312,652
1935	110,808	1951	342,900
1936	126,855	1952	369,149
1937	136,389	1953	370,938
1938	141,598	1954	397,566
1939	152,924	1955	410,205
1940	163,285	1956	448,663
1941	173,699	1957	420,405
1942	116,121		

TABLE 10

PHEASANT TAG SALES

Year	Number sold	Year	Number sold
1943	121,186	1953	214,753
1944	105,923	1954	221,621
1949	171,352	1955	219,587
1950	160,661	1956	231,157
1951	188,765	1957*	212,600
1952	205,041		

* Estimated.

TABLE 11

(Marine Resources)

POUNDS AND VALUE[1] OF COMMERCIAL FISH LANDINGS AND SHIPMENTS INTO CALIFORNIA

	1956		1957	
	Pounds	Value	Pounds	Value
Yellowfin tuna	203,885,489	$28,003,747	182,041,635	$23,610,316
Albacore	57,377,986	10,075,357	83,088,476	12,560,842
Skipjack	135,995,434	15,544,901	111,436,303	12,515,331
Bluefin tuna	12,788,843	1,669,979	20,637,570	2,449,093
Salmon	11,602,753	4,030,755	5,673,912	1,914,689
Sardine	69,561,145	1,673,705	45,862,106	1,786,545
Crab	14,320,459	1,816,116	19,114,359	1,639,219
Jack mackerel	75,762,110	1,531,587	82,011,785	1,603,191
Pacific mackerel	50,013,009	1,065,512	62,043,775	1,230,864
Rockfish	14,943,515	630,848	15,920,802	675,796
Abalone	4,284,063	480,584	5,421,914	587,320
Anchovy	56,920,585	721,792	40,547,526	508,762
Dover sole	8,268,424	391,299	7,912,083	388,361
Spiny lobster	735,994	384,722	647,547	377,406
Petrale sole	2,830,058	270,142	3,393,242	338,671
English sole	3,824,952	239,541	4,718,309	310,310
White seabass	1,090,710	257,333	1,507,095	276,325
Giant Pacific oyster	6,101,220	138,320	11,067,646	251,002
Squid	19,483,984	337,224	12,449,121	207,665
Sablefish	3,471,819	251,305	2,450,927	191,415
Swordfish	285,246	114,513	376,169	155,907
Lingcod	931,311	73,587	1,601,502	118,216
Ocean shrimp	1,168,519	99,945	1,376,641	117,014
California barracuda	752,527	134,216	683,213	105,725
All other	16,148,567	1,167,975	16,067,085	1,060,827
Totals	772,548,722	$71,105,005	738,050,743	$64,980,912

[1] Value to the fishermen.

TABLE 12

(Marine Resources)

CALIFORNIA FISHERIES PRODUCTION

	1956	1957	Total
Total landings and shipments, pounds	772,548,722	738,020,743	1,510,569,465
Cases of fish canned	15,835,706	15,802,218	31,637,924
Tons of fish meal produced	30,637	29,065	59,702
Gallons of fish oil produced	1,190,259	924,593	2,114,852
Gallons of liver oil produced	30,239	22,287	52,526

TABLE 13

(Director's Report)

CALIFORNIA HUNTING AND FISHING ECONOMIC SURVEY 1955

REPORTED HUNTING EXPENDITURES—1955

Categories on questionnaire	Average per hunter	Percent of total	Total spent
Hunting equipment—Guns, ammunition, bows, arrows, etc.	$70.01	26.4	$44,300,000
Automobile expenses—7½ cents per mile driven	52.64	19.8	33,312,500
Food and beverages—Meals, drinks, candy, etc.	47.07	17.7	29,790,400
Camping equipment—Tents, sleeping bags, stoves, etc.	18.24	6.9	11,544,000
Dog expenses—Purchase, food, Vet. and training fees	14.74	5.6	9,328,900
Clothing—Hiking boots, hunting jackets	8.97	3.4	5,677,100
Waterfowl hunting gear—Decoys, boats, motors, etc.	8.84	3.3	5,594,800
Lodging—Hotels, motels, cabin rentals	7.65	2.9	4,841,700
Private hunting clubs—Dues, shares, assessments	6.82	2.6	4,316,400
Transportation—(Not auto expense) Train, bus, plane, bridge tolls	6.16	2.3	3,898,600
Optical equipment—Binoculars, spotting scopes	6.02	2.3	3,810,000
Licenses*—Hunting, deer tags, duck stamps, pheasant tags	4.59	1.7	2,906,032
Game storage—Butcher service, food locker fees	3.53	1.3	2,234,100
Packing and guide fees—Pack trips, horse rental and feed	2.66	1.0	1,683,500
Books and magazines—on hunting subjects	2.72	1.0	1,721,500
Sportsmen's club—Initiation fees, dues, donations	1.64	0.6	1,037,900
Commercial hunting clubs—Hunting fees	1.35	0.5	854,400
Miscellaneous—Not under other categories	1.10	0.4	696,200
Hunting fees—Community or organizational hunting area fees	.42	0.2	265,800
Private land trespass fees	.38	0.1	240,500
Total	$265.55	100.0	$168,063,332

* Actual figures as supplied by the License Section of the California Department of Fish and Game, duck stamp figure as reported by the U. S. Fish and Wildlife Service.

REPORTED FISHING EXPENDITURES—1955

Fresh Water Fishing—Average 15 Days Per Licensee

Categories on questionnaire	Average per fisherman	Percent of total	Total spent
Transportation—Auto at 7½ cents per mile, plus train, bus, bridge tolls etc.	$63.19	29.0	$65,796,631
Food and drink—restaurant meals, caudy, ice cream, snacks	51.64	23.7	53,771,729
General purpose equipment—Boats, tents, sleeping bags, etc.	35.30	16.2	36,755,359
Fishing equipment—Rods, reels, tackle	23.10	10.6	24,049,803
Lodging—Motels, cabins, hotels	10.89	5.0	11,344,246
Rentals—Boats, motors, camping, fishing gear	10.24	4.7	10,663,591
Bait	9.15	4.2	9,529,167
Gas and oil—For boats and motors	4.36	2.0	4,537,698
License	*2.40	1.1	2,495,734
Repair, maintenance—Cost of repairing fishing equipment	1.96	0.9	2,041,964
Extra vehicle—Cost allotted on basis of use	1.96	0.9	2,041,964
Party and charter boat fees	1.53	0.7	1,588,194
Miscellaneous—Publications, club dues, initiations, donations	2.17	1.0	2,268,848
Total	$217.89	100.0	$226,884,935

Salt Water Fishing—Average 11 Days Per Licensee

Categories on questionnaire	Average per fisherman	Percent of total	Total spent
Transportation	$37.23	26.3	$23,837,636
Food and drink	28.73	20.3	18,399,392
General purpose equipment	15.85	11.2	10,151,389
Fishing equipment	16.28	11.5	10,423,301
Lodging	5.38	3.8	3,444,221
Rentals	5.94	4.2	3,806,770
Bait	6.23	4.4	3,988,045
Gas and oil	4.53	3.2	2,900,396
License	*1.56	1.1	997,011
Repair, maintenance	1.98	1.4	1,268,923
Extra vehicle	.57	.4	362,549
Party and charter boat fees	15.99	11.3	10,242,026
Miscellaneous	1.27	.9	815,736
3-day special licenses			1,589,630
Total	$141.54	100.0	$92,227,033

* Freshwater and saltwater license cost averages cannot be added to get an individual's actual license expenditure of $3. For those who reported fishing only in salt water, or only in fresh water, the entire $3 cost of the license was allotted to the appropriate fishery. For those who fished both salt and fresh water, the cost of license was divided in proportion to the number of days fished in each, and that share added to the exclusive fisheries totals. These were divided by the number of fishermen in each. (Similarly, batting averages of individual baseball players cannot be added to get the team average.)

TABLE 14

(Marine Resources)

COMMERCIAL FISHING FLEET

Homeport	1956-57	1957-58
Eureka	558	584
Sacramento	192	177
San Francisco	767	724
Monterey	473	461
Santa Barbara	237	266
Los Angeles	1,170	1,104
San Diego	641	615
Alaska, Washington, Oregon	314	324
Total number of boats	4,352	4,255

TABLE 15

(Marine Resources)

RESIDENCE OF LICENSED COMMERCIAL FISHERMEN

Region of residence	Number of fishermen, 1956-57	Number of fishermen, 1957-58
Eureka	1,016	1,057
Sacramento	383	331
San Francisco	1,413	1,281
Monterey	905	896
Santa Barbara	479	571
Los Angeles	2,685	2,530
San Diego	2,299	2,278
Alaska, Washington and Oregon fishermen licensed in California	599	625
Mexican nationals licensed in California	18	15
Other registry	14	11
Totals	9,811	9,595

TABLE 16

(Marine Resources)

TOTAL ANNUAL LANDINGS AND SHIPMENTS INTO CALIFORNIA OF COMMERCIAL FISH, MOLLUSKS, AND CRUSTACEANS

Includes Sardine Deliveries to Reduction Ships During 1930 Through 1938

Year	Pounds	Year	Pounds
1916	95,002,695	1936	1,764,900,136
1917	209,876,670	1937	1,362,983,717
1918	261,134,265	1938	1,310,595,651
1919	266,270,240	1939	1,486,534,906
1920	222,004,376	1940	1,297,517,441
1921	135,347,826	1941	1,529,147,645
1922	182,343,333	1942	1,173,414,078
1923	253,874,581	1943	1,234,049,119
1924	340,445,919	1944	1,459,445,859
1925	437,502,232	1945	1,216,467,433
1926	394,964,393	1946	919,850,476
1927	487,166,143	1947	795,498,998
1928	583,526,751	1948	900,499,994
1929	856,854,055	1949	1,135,338,504
1930	702,188,795	1950	1,366,677,048
1931	502,389,875	1951	904,099,052
1932	556,139,053	1952	694,978,340
1933	821,805,007	1953	618,919,416
1934	1,390,798,650	1954	713,410,126
1935	1,448,016,584	1955	710,713,523
		1956	772,548,722
		1957	738,020,743

TABLE 17

(Marine Resources)

POUNDS OF LIVE BAIT TAKEN BY THE VESSELS SUPPLYING THE PARTY BOAT FLEET

Year	Pounds	Year	Pounds
1947	7,701,000	1953	12,978,000
1948	9,145,000	1954	13,672,000
1949	9,065,000	1955	12,486,000
1950	11,058,000	1956	13,180,680
1951	13,228,000	1957	13,006,750
1952	14,365,000		

TABLE 18

(Marine Resources)

MARKET CRAB LANDINGS

Year	Pounds	Year	Pounds
1916	1,296,912	1937	1,627,753
1917	2,580,840	1938	3,873,600
1918	1,619,280	1939	5,953,361
1919	1,304,904	1940	5,151,014
1920	1,220,568	1941	4,260,340
1921	800,952	1942	2,414,110
1922	860,328	1943	2,315,338
1923	1,075,800	1944	2,925,316
1924	1,506,816	1945	4,333,895
1925	3,234,312	1946	9,633,630
1926	3,296,280	1947	10,733,398
1927	2,960,712	1948	11,912,191
1928	3,574,464	1949	11,133,046
1929	1,792,776	1950	11,721,352
1930	1,992,384	1951	11,568,353
1931	2,231,384	1952	12,997,411
1932	2,433,987	1953	8,278,257
1933	3,208,494	1954	7,829,651
1934	3,768,081	1955	6,119,320
1935	3,680,188	1956	14,320,459
1936	2,311,802	1957	19,114,359

TABLE 19

(Marine Resources)

GIANT PACIFIC OYSTER LANDINGS

Year	Pounds	Year	Pounds
1933	68,762	1946	88,006
1934	50,240	1947	46,035
1935	299,375	1948	166,524
1936	310,683	1949	235,134
1937	680,081	1950	143,612
1938	1,207,421	1951	133,700
1939	1,659,355	1952	180,141
1940	1,292,505	1953	161,520
1941	1,717,781	1954	460,620
1942	609,233	1955	1,635,067
1943	741,105	1956	6,101,220
1944	636,686	1957	11,067,646
1945	309,738		

TABLE 20

(Marine Resources)

ABALONE LANDINGS

Year	Pounds	Year	Pounds
1948	3,228,927	1953	4,720,350
1949	3,599,998	1954	4,099,525
1950	3,954,791	1955	4,185,875
1951	4,084,115	1956	4,284,063
1952	4,784,033	1957	5,421,914

TABLE 21

(Marine Resources)

SALMON LANDINGS IN POUNDS

Year	Ocean caught	Sacramento-San Joaquin Rivers[2]	Other rivers[1]	Total pounds
1916	5,592,216	3,450,787	1,896,591	10,939,594
1917	6,085,997	3,975,187	999,097	11,060,581
1918	5,933,346	5,938,029	1,221,813	13,093,188
1919	7,208,382	4,529,222	1,408,123	13,145,727
1920	6,066,190	3,860,312	1,207,317	11,133,819
1921	4,483,105	2,511,127	996,700	7,990,932
1922	4,338,317	1,765,066	1,131,741	7,235,124
1923	3,736,924	2,243,945	1,109,391	7,090,260
1924	6,374,573	2,640,110	1,000,886	10,015,269
1925	5,481,536	2,778,846	1,265,371	9,525,753
1926	3,863,677	1,261,776	958,626	6,084,079
1927	4,921,600	920,786	669,543	6,511,929
1928	3,444,306	553,777	480,483	4,478,566
1929	4,033,660	581,497	429,714	5,044,871
1930	4,085,650	1,213,698	703,546	6,002,894
1931	3,666,841	941,605	686,065	5,294,511
1932	2,649,194	1,264,987	703,990	4,618,171
1933	3,657,661	454,253	446,520	4,558,434
1934	3,921,530	397,572		4,319,102
1935	4,773,112	888,868		5,661,980
1936	4,033,475	949,179		5,042,654
1937	5,934,696	974,871		6,909,867
1938	2,170,921	1,668,376		3,839,297
1939	2,238,755	496,933		2,735,688
1940	5,160,403	1,515,588		6,675,991
1941	2,945,994	844,963		3,790,957
1942	4,063,306	2,552,944		6,616,250
1943	5,285,527	1,295,424		6,580,951
1944	7,021,848	3,265,143		10,286,991
1945	7,912,754	5,467,960		13,380,714
1946	7,134,472	6,524,991		13,659,463
1947	8,080,780	3,403,808		11,484,588
1948	5,829,377	1,932,493		7,761,870
1949	5,530,674	898,364		6,429,038
1950	5,856,850	1,150,313		7,007,163
1951	5,840,984	1,243,395		7,084,379
1952	6,500,390	702,352		7,202,742
1953	6,973,227	865,723		7,838,950
1954	8,597,663	900,961		9,498,624
1955	9,658,820	2,320,746		11,979,566
1952	6,536,855	738,081		7,274,936
1953	7,136,485	869,696		8,006,181
1954	8,589,579	900,961		9,500,540
1955	9,656,996	2,320,746		11,977,742
1956	10,274,902	1,139,585		11,414,487
1957	5,176,968	321,824		5,498,792

[1] Eel, Klamath, Mad and Smith Rivers were closed to commercial fishing in 1934.
[2] Sacramento-San Joaquin River system was closed to commercial fishing in September, 1957.

TABLE 23

(Marine Resources)

SKIPJACK

Landings and Shipments in Pounds

Year	Fishing boat landings	Shipments	Total
1948	58,770,706	1,364	58,772,070
1949	78,521,918	52,739	78,574,657
1950	124,779,419	3,261,659	128,041,078
1951	115,886,848	2,750,824	118,637,672
1952	84,736,126	4,155,541	88,891,667
1953	122,306,183	8,347,736	130,653,919
1954	153,756,190	15,707,756	169,463,946
1955	101,890,956	18,634,023	120,524,979
1956	120,153,222	15,842,212	135,995,434
1957	90,547,713	20,888,590	111,436,303

TABLE 24

(Marine Resources)

BLUEFIN TUNA

Landings and Shipments in Pounds

Year	Fishing boat landings	Shipments	Total
1948	6,528,807	168,180	6,696,987
1949	4,389,390		4,389,390
1950	2,738,963	107,878	2,846,841
1951	3,862,394	2,112	3,864,506
1952	4,576,685		4,576,685
1953	9,772,615	62,447	9,835,062
1954	21,024,820	638,286	21,663,106
1955	13,609,177	343,346	13,952,523
1956	12,625,968	162,875	12,788,843
1957	20,314,546	323,024	20,637,570

TABLE 22

(Marine Resources)

YELLOWFIN TUNA

Landings and Shipments in Pounds

Year	Fishing boat landings	Shipments	Total
1948	191,723,801		191,723,801
1949	184,972,285	639,809	185,612,094
1950	182,315,834	8,130,632	190,446,466
1951	160,246,175	13,422,415	173,668,590
1952	178,437,493	7,080,197	185,517,690
1953	132,086,346	8,458,606	140,544,952
1954	119,401,795	29,701,838	149,103,603
1955	122,291,864	40,526,143	162,818,007
1956	149,280,976	54,604,513	203,885,489
1957	136,955,837	45,085,798	182,041,635

TABLE 25

(Marine Resources)

ALBACORE

Landings and Shipments in Pounds

Year	Fishing boat landings	Shipments	Total
1948	36,460,157	1,149,632	37,609,789
1949	44,006,280	284,040	44,290,320
1950	61,745,994	4,378,420	66,124,414
1951	30,915,342	17,520,891	48,436,233
1952	49,802,791	22,525,248	72,328,039
1953	33,835,905	46,186,816	80,022,721
1954	26,107,290	38,466,383	64,573,673
1955	29,002,298	44,844,675	73,846,973
1956	37,055,211	20,322,775	57,377,986
1957	43,524,449	39,564,027	83,088,476

TABLE 26

(Marine Resources)

SEASONAL CATCH IN TONS * OF SARDINES ALONG THE PACIFIC COAST—EACH SEASON INCLUDES JUNE THROUGH THE FOLLOWING MAY

Season	British Columbia	Washington	Oregon	Total Pacific northwest	California						Grand total	California percent of total
					Floating plants	San Francisco	Monterey	San Pedro	San Diego	Total California		
1916-17							7,710	17,380	2,440	27,530	27,530	100
1917-18	80			80		70	23,810	41,340	7,360	72,580	72,660	100
1918-19	3,640			3,640		450	35,750	32,530	6,810	75,540	79,180	95
1919-20	3,280			3,280		1,000	43,040	16,580	6,410	67,030	70,310	95
1920-21	4,400			4,400		230	24,960	11,740	1,520	38,450	42,850	90
1921-22	990			990		80	16,290	19,220	910	36,500	37,490	97
1922-23	1,020			1,020		110	29,210	33,170	2,620	65,110	66,130	98
1923-24	970			970		190	45,920	35,040	2,780	83,930	84,900	99
1924-25	1,370			1,370		560	67,310	96,330	8,820	173,020	174,390	99
1925-26	15,950			15,950		560	69,010	61,990	5,710	137,270	153,220	90
1926-27	48,500			48,500		3,520	81,860	64,720	2,110	152,210	200,710	76
1927-28	68,430			68,430		16,690	98,020	67,900	4,650	187,260	255,690	73
1928-29	80,510			80,510		13,520	120,290	119,250	1,420	254,480	334,990	76
1929-30	86,340			86,340		21,960	160,050	140,540	2,620	325,170	411,510	79
1930-31	75,070			75,070	10,960	25,970	106,620	38,490	80	185,120	260,190	71
1931-32	73,600			73,600	31,040	21,610	69,080	42,660	260	164,650	238,250	69
1932-33	44,350			44,350	58,790	18,630	89,600	83,600	60	250,680	295,030	85
1933-34	4,050			4,550	67,820	36,340	152,480	125,050	1,750	383,440	387,490	99
1934-35	43,000			43,000	112,040	69,000	230,860	178,820	4,860	595,580	638,580	93
1935-36	45,320	10	26,230	71,560	150,830	76,150	184,470	138,400	10,650	560,500	632,060	89
1936-37	44,450	6,560	14,200	65,210	235,610	141,100	206,710	138,110	4,590	726,120	791,330	92
1937-38	48,080	17,100	16,660	81,840	67,580	133,720	104,930	109,050	380	416,560	498,400	84
1938-39	51,770	26,480	17,020	95,270	43,890	201,200	180,990	146,400	2,780	575,260	670,530	86
1939-40	5,520	17,760	22,330	45,610		212,450	227,870	101,820	110	542,250	587,860	92
1940-41	28,770	810	3,160	32,740		118,090	165,700	175,590	1,200	460,580	493,320	93
1941-42	60,050	17,100	15,850	93,000		186,590	250,290	148,910	1,580	587,370	680,370	86
1942-43	65,880	580	1,950	68,410		115,880	184,400	201,510	2,870	504,660	573,070	88
1943-44	88,740	10,440	1,820	101,000		126,510	213,620	135,310	2,690	478,130	579,130	83
1944-45	59,120	20		59,140		136,600	237,250	178,260	2,770	554,910	614,050	90
1945-46	34,300	2,310	90	36,700		84,100	145,520	173,110	950	403,680	440,380	92
1946-47	3,990	6,140	3,960	14,090		2,870	31,240	194,720	4,770	233,600	247,690	94
1947-48	490	1,360	6,930	8,780		90	17,630	101,150	2,460	121,330	130,110	93
1948-49		50	5,320	5,370		110	47,830	131,860	3,920	183,720	189,090	97
1949-50						16,090	130,990	187,260	3,280	337,620	337,620	100
1950-51						12,730	19,100	318,350	2,910	353,090	353,090	100
1951-52						80	640	127,030	1,350	129,100	129,100	100
1952-53							10	5,680	30	5,720	5,720	100
1953-54								4,140	320	4,460	4,460	100
1954-55							10	66,770	490	67,270	67,270	100
1955-56							470	73,990		74,460	74,460	100
1956-57							60	33,560	20	33,640	33,640	100
1957-58							20	22,210		22,230	22,230	100

* Data for British Columbia were supplied by the Canadian Bureau of Statistics and the Province of British Columbia, those for Washington by the Washington Department of Fisheries, and for Oregon by the Fish Commission of Oregon. Tonnages delivered to the floating plants were compiled by the United States Fish and Wildlife Service from the books of the companies operating off the California coast. California landings were derived from the records of the California Department of Fish and Game.

TABLE 27

(Marine Resources)

CALIFORNIA JACK MACKEREL LANDINGS BY SEASONS

Season (May 1-April 30)	Pounds	Season (May 1-April 30)	Pounds
1926-27	365,245	1942-43	9,794,416
1927-28	425,197	1943-44	8,454,883
1928-29	556,550	1944-45	13,742,894
1929-30	673,936	1945-46	9,280,072
1930-31	310,894	1946-47	31,146,258
1931-32	672,679	1947-48	142,660,570
1932-33	465,351	1948-49	55,690,542
1933-34	1,106,317	1949-50	64,987,587
1934-35	1,653,549	1950-51	136,374,757
1935-36	9,849,115	1951-52	74,990,835
1936-37	5,757,158	1952-53	151,470,361
1937-38	8,242,112	1953-54	35,061,944
1938-39	3,925,278	1954-55	18,834,458
1939-40	1,117,895	1955-56	59,347,100
1940-41	1,749,646	1956-57	96,345,640
1941-42	1,917,129	1957-58	39,833,547

TABLE 28

(Marine Resources)

PACIFIC MACKEREL LANDINGS BY SEASONS

Season (May 1-April 30)	Pounds	Season (May 1-April 30)	Pounds
1926-27	3,593,962	1942-43	48,220,187
1927-28	6,455,033	1943-44	77,853,106
1928-29	39,405,114	1944-45	80,785,336
1929-30	56,694,637	1945-46	52,002,734
1930-31	12,805,751	1946-47	58,896,372
1931-32	15,152,465	1947-48	39,627,373
1932-33	10,850,403	1948-49	38,202,903
1933-34	72,873,851	1949-50	50,061,684
1934-35	113,464,209	1950-51	33,890,004
1935-36	146,387,327	1951-52	31,904,919
1936-37	100,745,270	1952-53	18,761,833
1937-38	70,445,621	1953-54	7,612,679
1938-39	76,064,647	1954-55	27,210,207
1939-40	99,960,747	1955-56	26,896,627
1940-41	107,553,929	1956-57	57,184,330
1941-42	71,754,709	1957-58	56,238,463

TABLE 29

(Marine Resources)

ANCHOVY LANDINGS IN POUNDS

Year	Commercial	Live bait	Commercial and live bait
1916	531,209		
1917	528,753		
1918	868,161		
1919	1,609,548		
1920	569,774		
1921	1,946,881		
1922	652,516		
1923	307,074		
1924	346,951		
1925	93,071		
1926	60,157		
1927	368,201		
1928	357,470		
1929	382,445		
1930	319,561		
1931	307,494		
1932	299,217		
1933	317,992		
1934	237,505		
1935	178,970		
1936	195,122		
1937	226,229		
1938	735,144		
1939	2,147,901		
1940	6,317,797		
1941	4,105,382		
1942	1,694,290		
1943	1,570,803		
1944	3,891,029		
1945	1,616,880		
1946	1,921,627		
1947	18,940,521		
1948	10,835,930	7,450,993	18,286,923
1949	3,322,273	5,604,735	8,927,008
1950	4,878,587	7,647,640	12,526,327
1951	6,954,852	10,283,730	17,238,582
1952	55,782,870	13,620,879	69,403,749
1953	84,503,703	12,783,016	97,286,719
1954	42,410,214	13,372,042	55,782,256
1955	44,691,582	12,250,890	56,942,472
1956	56,920,585	13,102,056	70,022,641
1957	40,517,526	10,748,560	51,266,086

TABLE 30

(Inland Fisheries)

MAJOR NEW PUBLIC FISHING WATERS

New Waters Opened Between July 1, 1956, and June 30, 1958

Name of water	County	Surface area in acres	Operating agency
Nacimiento Reservoir	San Luis Obispo	5,370	Monterey County Flood Control and Water Conservation District
Santa Margarita Reservoir	San Luis Obispo	7,900	U. S. Corps of Engineers
Uvas Reservoir	Santa Clara	280	Saota Clara County Flood Control and Water Conservation District
Berryessa Reservoir	Napa	19,600	U. S. Bureau of Reclamatioo
Wishoo Reservoir	Fresoo	1,050	Southern Califoroia Edison Co.
Portal Forebay	Fresno	25	Southern California Edison Co.
Beardsley Reservoir	Tuolumoe	720	South San Joaquin-Oakdale Irrigation Districts
Donnells Reservoir	Tuolumne	425	South San Joaquin-Oakdale Irrigation Districts
Tulloch Reservoir	Tuolumne	1,260	South San Joaquin-Oakdale Irrigation Districts
Avocado Lake	Fresno	83	Fresno County*
Pleasaot Valley Reservoir	Toyo	115	Los Angeles Water and Power Co.

* Developed with Wildlife Conservation Board Funds.

TABLE 31

(Inland Fisheries)

CHEMICAL CONTROL OF UNDESIRABLE FISH POPULATIONS

July 1, 1956, through June 30, 1958

Name of water	County	Lake surface area in acres or miles of stream: At time of treatment	Lake surface area in acres or miles of stream: When full	Date	Species restocked
Region I					
Medicine Lake	Siskiyou	425	425	Sept., 1956	Rainbow trout
Little Medieine Lake	Siskiyou	3.6	3.6	Sept., 1956	Rainbow trout
Crater Lake	Lassen	28.4	28.4	Oct., 1956	Rainbow trout
Region II					
Virginia Lake	Nevada	3.4	3.4	Sept., 1956	Eastern brook
Upper Eastern Brook Lake	Nevada	4.0	4.0	Sept., 1956	Eastern brook
Lower Eastern Brook Lake	Nevada	6.6	6.6	Sept., 1956	Eastern brook
Sterling Lake	Nevada	65.0	105.0	Sept., 1956	Rainbow trout
*Summit Lake	Alpine	12.5	12.5	Sept., 1956	Eastern brook
*Elephant Rock Lake	Alpine	7.3	7.3	Sept., 1956	Eastern brook
Bull Lake	Alpine	6.8	6.8	Sept., 1956	Piute trout
Lower Kinney Lake	Alpine	23.0	28.0	Oct., 1956	Cutthroat trout
Deadman Lake	Sierra	6.4	6.4	Oct., 1956	Eastern brook
Culbertson Lake	Nevada	84.1	93.8	Sept., 1957	Rainbow trout
Upper Beyers Lake	Nevada	5.7	5.7	Sept., 1957	Rainbow trout
Lower Beyers Lake	Nevada	18.3	18.3	Sept., 1957	Rainbow trout
Max Lake	Nevada	8.8	8.8	Sept., 1957	Eastern brook
Buck Island Lake	El Dorado	27.0	42.0	Oct., 1957	Eastern brook
†Deer Lake	Placer	8.9	8.9	Oct., 1957	None
Kidd Lake	Placer	26.0	88.0	Sept., 1957	Eastern brook
Kilborn Lake	Placer	10.5	10.5	Oct., 1957	Eastern brook
Long Lake	Placer	8.2	8.2	Oct., 1957	Eastern brook
Alpine Lake	Alpine	3.0	179.0	Oct., 1957	Rainbow trout
Region III					
Nacimiento River	San Luis Obispo	58 mi.		Dec., 1956 Jan., 1957	‡
Russian River, East Branch	Mendocino	20 mi.		Oct., 1957	‡
Region IV					
Woodward Reservoir	Stanislaus	200	2,500	Nov., 1956	Bluegill sunfish Channel catfish Largemouth bass White crappie
Lost Lake	Fresno	48	48	Dec., 1956	Largemouth bass Redear sunfish White catfish White crappie
Hume Lake	Fresoo	5	85	Dec., 1957	Rainbow trout
Cabio Lake	Madera	5	5	Oct., 1956	Golden trout
Region V					
Santa Margarita River	Riverside and San Diego	6 mi.		Sept., 1956	Largemouth bass
Big Bear Lake	San Bernardino	500	2,600	Oct., 1956	Rainbow trout Largemouth bass Bluegill Chaonel eatfish
El Capitan Reservoir	San Diego	(partial treatment of shoreline)	(5 mi. of shore)	Oct., 1956	Largemouth bass
Lake O'Neill	San Diego	20	100	Oct., 1956	Largemouth bass Redear sunfish
Sunbeam Lake	Imperial	10	10	Oct., 1957	Largemouth bass Bluegill sunfish Chaoel catfish
Naval Air Station Pond	Imperial	10	10	Oct., 1957	Largemouth bass Bluegill sunfish Chaoel catfish
Hemet Lake	Riverside	43	470	Nov., 1957	Smallmouth bass Raiobow trout
Upper Otay Reservoir	San Diego	40	139	Dec., 1957	Largemouth bass
San Dieguito Reservoir	San Diego	75	75	Mar., 1958	Largemouth bass
Ramer Lake, Upper Basin	Imperial	20	100	May, 1958	Largemouth bass Channel catfish Bluegill sunfish

* Summit and Elephant Rock Lakes were retreated after an unsuccesful aerial treatment in 1954.

† Deer Lake is a private lake owned by the West Contra Costa Girl Scout Counell. Public fishing is not allowed but it was treated to elimlnate the danger of reinfestation of nearby lakes with rough fish.

‡ Done in connection with new reservoir construction.

TABLE 32

(Inland Fisheries)

STREAM IMPROVEMENT

July 1, 1956, through June 30, 1958

Name of Water and County	Number of pool forming devices	Number of fish screens installed	Number of fish ladders built	Flow maintenance dams built	Barriers eliminated
Region I					
Trinity River, Trinity	--	--	--	--	1
Elk Creek, Siskiyou	--	--	--	--	1
Lassen Creek, Modoc	--	--	--	--	1
Big Creek, Trinity	--	--	--	--	1
Beaver Creek, Siskiyou	--	--	--	--	2
Fall Creek, Siskiyou	--	--	--	--	3
Hutton Creek, Siskiyou	--	--	1	--	--
Grassy Creek, Humboldt	--	--	--	--	2
Clear Creek, Siskiyou	--	--	--	--	1
Mill Creek, Tehama	--	1	--	--	1
Salmon Creek, Humboldt	--	--	--	--	1
Mill Creek, Del Norte	--	--	--	--	1
Knopti Creek, Del Norte	--	--	--	--	1
Battle Creek, Shasta	--	--	--	--	2
Pine Creek, Modoc	6	--	--	--	--
Clear Creek, Shasta	--	--	1	--	--
Deer Creek, Tehama	--	2	--	--	--
Patterson Creek, Siskiyou	--	2	--	--	--
Mill Creek, Siskiyou	--	1	--	--	--
Shackleford Creek, Siskiyou	--	3	--	--	--
Region II					
Mokelumne River, South Fork, Calaveras	7	--	1*	--	--
Ward Creek, Placer	--	--	1*	--	--
Feather River, South Fork, Butte	--	--	--	--	--
Upper Truckee River, El Dorado	--	1	--	--	--
Blue Creek, Alpine	--	--	--	--	1
Rubicon River, El Dorado	--	--	--	1	--
Region III					
San Geronimo Creek, Marin	--	--	--	--	2
Big Sulphur Creek, Sonoma	--	--	--	--	1
Bean Creek, Santa Cruz	--	--	--	--	1
Bolinas Creek, Marin	--	--	1	--	--
Region IV					
Kaiser Creek, Fresno	--	--	--		2
Ward Mountain Creek, Fresno	--	--	--		2
Granite Creek, Madera	--	--	--	1	--
Big Creek, Fresno	--	--	--	--	1
Peppermint Creek, Tulare	4	--	--		
Cherry Creek, Tuolumne	--	--	--	1	
Little Kern Lake Creek, Tulare	--	--	--	1	
Beasore Creek, Madera	--	--	--	--	1
Region V					
Fish Canyon Creek, Los Angeles	31	--	--	--	--
San Gabriel River, Los Angeles	16	--	--	--	--
Lion Canyon Creek, Ventura	10	--	--	--	--
Reyes Creek, Ventura	2	--	--	--	--
Sespe Creek, Ventura	1	--	--	--	--
Tequepis Creek, Santa Barbara	1	--	--	--	--

* Fish ladders on these streams were built by the owner of the dam after investigation by Department of Fish and Game personnel demonstrated that the ladders were necessary and feasible.

TABLE 33

(Inland Fisheries)

FARM PONDS

July 1, 1956, through June 30, 1958

Region	Number of applications	Number of ponds stocked
I	46	44
II	109	101
III	149	79
IV	107	71
V	188	106
Totals	599	401

TABLE 34

(Inland Fisheries)

FISH SALVAGED AND TRANSPLANTED

Species	Number 1956-57	Number 1957-58
Warmwater fish		
Largemouth bass	865,806	295,685
Smallmouth bass	66,620	21,926
Bluegill	43,336	10,398
Warmouth bass	365	------
Black crappie	997	22,047
White crappie	405	4,235
Channel catfish	16,163	2,887
White catfish	17,092	35,497
Brown bullhead	31,025	9,213
Black bullhead	------	600
Striped bass	133	316
Redear sunfish	25,210	758
Green sunfish	------	80
American shad	------	56
Threadfin shad	6,650	23,450
Fathead minnow	3,800	1,350
Golden shiner	11,100	225
Total	1,088,702	338,723
Salmon		
King	3,326	3,193
Silver	6,889	14,039
Total	10,215	17,232
Trout		
Rainbow	5,692	6,100
Brown	72	------
Cutthroat	112,002	2,081
Steelhead	454,815	655,083
Total	572,581	663,264
GRAND TOTAL	1,671,498	1,019,219

TABLE 35

(Inland Fisheries)

HATCHERY-REARED WARMWATER FISH PLANTED

Species	Number 1956-57	Number 1957-58
Largemouth bass	398,325	14,360
Smallmouth bass	99,530	10,457
Bluegill	4,300	752
Redear sunfish	59,146	195,372
Channel catfish	------	21,050
White catfish	90	------
Fathead minnow	118,335	------
Golden shiner	280	------
Plains red shiner	600	------
Total	680,606	241,991

TABLE 36

(Inland Fisheries)

TROUT AND SALMON PLANTING TRENDS

Year	Fingerling Number	Fingerling Pounds	Subcatchable* Number	Subcatchable* Pounds	Catchable Number	Catchable Pounds
1949-50	16,290,943	70,542	------	------	2,591,182	417,855
1950-51	14,918,164	61,901	------	------	2,833,599	468,339
1951-52	11,815,287	40,182	------	------	3,675,305	539,554
1952-53	13,452,418	40,826	------	------	4,586,840	747,721
1953-54	13,512,282	46,747	------	------	5,261,740	796,384
1954-55	10,294,133	49,261	------	------	7,599,905	1,191,428
1955-56	18,119,846	85,020	80,535	7,116	7,584,721	1,240,576
1956-57	16,020,575	75,620	715,866	68,759	8,034,675	1,627,341
1957-58	13,217,402	94,340	1,843,827	178,897	7,951,922	1,691,823

* 1955-56 first year subcatchables were separated.

TABLE 37

(Salmon and Steelhead)

SALMON AND STEELHEAD COUNTING STATIONS

Klamathan Racks, Klamath River, Siskiyou County

Season	King salmon
1956-57	6,770
1957-58	2,436

Shasta River Racks, Shasta River, Siskiyou County

Season	King salmon
1956-57	No count
1957-58	2,234*

Sweasey Dam, Mad River, Humboldt County

Season	King salmon	Silver salmon	Steelhead
1956-57	129	21	2,717
1957-58	495	11	1,957

Benbow Dam, South Fork Eel River, Humboldt County

Season	King salmon	Silver salmon	Steelhead
1956-57	1,530	5,717	12,333
1957-58	3,050	5,432	7,910

Clough Dam, Mill Creek, Tehama County

Season	King salmon (fall run)	King salmon (spring run)	Silver salmon	Steelhead
1956-57	131	1,201	201	1,443
1957-58	1,341	2,213	1,523	1,302

Woodbridge Dam, Mokelumne River, San Joaquin County

Season	King salmon	Silver salmon	Steelhead
1956-57	474	0	13
1957-58	2,400	1	7

* New counting station constructed 150 yards above confluence of Shasta and Klamath Rivers. Counts from 1938 through 1955 were made upstream 6½ miles from present station. Earlier counts were made at site of present station.

TABLE 38

(Salmon and Steelhead)

CALIFORNIA SALMON CATCH SAMPLING

	Ocean Commercial Troll[1]			
	1956		1957	
	King	Silver	King	Silver
Number fish examined	148,197	16,036	39,982	6,372
Average weight of fish (lbs.)	10.2	6.8	9.8	6.1
Percent of landings by wt.	95.5	4.5	89.8	10.2
	River gill net[2]			
Number fish examined	8,759	----------	1,812	34
Average weight of fish (lbs.)	16.7	----------	18.3	11.1
Percent of landings by weight	100.0	----------	98.2	1.8

[1] 15.5 percent of total catch sampled in 1956 and 7.7 percent in 1957.
[2] 12.8 percent of total catch sampled in 1956 and 12.3 percent in 1957. No silver salmon taken by river gill net fishery in 1956.

TABLE 39

(Salman and Steelhead)

CALIFORNIA KING AND SILVER SALMON LANDINGS

1952-1957

(In Thousands of Fish)

Fishery	1952	1953	1954	1955	1956	1957
Commercial troll (ocean)	566	590	835	803	1,026	571
Party boat (ocean)	80	94	108	126	115	43
Total ocean[1]	646	684	943	929	1,141	614
Gill net (river)	38	40	57	121	68	17[2]

[1] Minimal—skiff fishery landings not included.
[2] Through September 26th only—fishery no longer permitted.

TABLE 40

(Salmon and Steelhead)

CENTRAL VALLEY KING SALMON SPAWNING STOCK

1952-1957—FALL RUN ONLY

	Number fish (thousands)
1952	412
1953	593
1954	521
1955	500
1956	200
1957	121

TABLE 41

(Inland Fisheries)

HATCHERY-REARED TROUT AND SALMON DISTRIBUTION

1956-57 Fiscal Year

County	Trout											Salmon			
	Rainbow			Eastern Brook	Brown		Cutthroat		Golden	Steelhead		Silver	King		Kokanee
	Catchable	Subcatchable	Fingerling	Fingerling	Catchable	Fingerling	Catchable	Fingerling	Fingerling	Yearling	Fingerling	Yearling	Yearling	Fingerling	Fingerling
Alameda	16,843														
Alpine	204,829		32,195	63,710				134,020	3,100						
Amador	79,194	7,000	100,000	21,420											
Butte	101,370														
Calaveras	99,473		4,000	3,000							19,350				
Colusa	15,310														
Del Norte											104,352				
El Dorado	216,548		1,900,655	336,422		18,627		670,580			31,779				
Fresno	532,896	101,195	178,889	96,565					97,530						
Glenn	1,270		4,000												
Humboldt			87,024	5,980				112,002		31,169	105,096				
Inyo	508,286	11,000	214,913	34,080		319,004			106,960						
Kern	204,519		137,342												
Lake	89,844					5,000									
Lassen	79,327	6,600	294,692	100,650			258	143,200							
Los Angeles	264,365		163,345												
Madera	152,934		109,100	31,490					13,370						86,880
Marin	102,471		65,080												
Mariposa	146,297		381,963	33,618											
Mendocino	3,952									32,450					
Modoc	22,289	15,078	33,028	4,494		136,035		40,800							
Mono	1,166,454	315,200	141,620	188,805	985	516,070		258,400	47,040						
Monterey	93,919					219									
Napa	27,478														
Nevada	269,731		178,840	164,266											75,298
Orange	18,870														
Placer	30,837		960,486	38,307											
Plumas	180,839		180,640	143,496											
Riverside	102,930		30,000												
Sacramento		10,000	204,000							8,262	26,166		20,579	162,930	
San Bernardino	762,840		827,962			9,696									
San Diego	65,735														
San Francisco	91,548		801,299												
San Joaquin											291,056				
San Luis Obispo	91,550														
San Mateo	100,284														
Santa Barbara	16,696	26,250	547,274			2,010									
Santa Clara	102,062		111,350												
Santa Cruz	60,757										66,000	46,160			
Shasta	365,142	900	306,048	28,534		92,716									
Sierra	112,087	20,100	74,786	16,633	1,315	20,050		60,525							49,590
Siskiyou	243,091		263,002	207,150		64,614								1,482,305	
Solano		24,724													
Sonoma	4,146														
Stanislaus											20,010				
Tehama	183,627			3,000								53,510			
Trinity	17,530		126,927	108,448		10,030									
Tulare	440,030		67,372	15,120		27,695									
Tuolumne	420,139	30,480	324,118	62,612											
Ventura	140,631	34,700	30,720												
Yuba	2,556														
Totals	7,952,626	603,227	8,882,670	1,707,800	2,300	1,221,766	258	1,419,527	268,000	71,881	663,809	99,670	20,579	1,645,235	211,768

TABLE 42

(Inland Fisheries)

HATCHERY-REARED TROUT AND SALMON DISTRIBUTION

1957-58 Fiscal Year

County	Trout											Salmon			
	Rainbow			Eastern Brook	Brown		Cutthroat		Golden	Steelhead		Silver	King		Kokanee
	Catchable	Subcatchable	Fingerling	Fingerling	Catchable	Fingerling	Catchable	Fingerling	Fingerling	Yearling	Fingerling	Yearling	Yearling	Fingerling	Fingerling
Alameda	29,586														
Alpine	165,206		30,970	72,444			140,840		3,000						30,820
Amador	89,427	22,275	101,150	14,742											
Butte	96,891														
Calaveras	82,199		4,005	3,000											
Colusa	14,188														
Del Norte			1,960							49,730					
El Dorado	185,376	14,400	771,096	325,940			33,280								
Fresno	566,454	60,138	691,921	136,662					115,128						202,400
Glenn	2,123														
Humboldt							13,968								
Inyo	488,802		332,185	94,940	2,450	398,100			14,500						
Kern	157,450		153,865												
Lake	105,602		75,020			32,480									
Lassen	63,734	6,000	56,497												
Los Angeles	318,359	19,030				7,025									
Madera	132,476		118,510	53,349					2,800						
Marin	95,630	250,875	69,564												
Mariposa	124,281		570,105	44,420					3,400						
Mendocino	9,085		130,334							95,373	45,110				
Modoc	51,659	6,005	4,000				96,580								
Mono	1,053,480	497,265	171,775	288,740		187,350	289,808	760	6,000						50,240
Monterey	93,205					11,500									
Napa	19,239														
Nevada	251,170		110,970	150,244											123,280
Orange	33,930														
Placer	17,022		603,788	40,154											
Plumas	160,415	166,000	212,302	115,752											
Riverside	116,095	46,400				2,000									
Sacramento			200,013							381,323	626,722		690	1,233,191	
San Bernardino	600,730	40,784	420,574			9,770									299,300
San Diego	88,625					6,990									
San Francisco	48,949	100,200	1,003,147	45,500											
San Joaquin											235,520				
San Luis Obispo	74,757														
San Mateo	84,914														
Santa Barbara	24,160		239,048			7,112									
Santa Clara	47,687	200,250	89,522								66,336				
Santa Cruz	66,661									55,000					
Shasta	376,450	20,402	34,640	21,582		36,000									
Sierra	122,650	65,344	85,432	25,530	3,525						4,004				
Siskiyou	210,888	60,260	13,980											255,500	
Solano		39,486													
Sonoma	2,830														
Tehama	153,705		5,000									3,610			
Trinity	15,600		37,000	3,600								45,200			
Tulare	309,613		40,009	27,028					5,100						
Tuolumne	555,157	12,600	498,287	114,072											
Ventura	185,773	33,600	160,792			7,088									
Yuba	4,541														
Totals	7,496,774	1,661,314	7,037,461	1,577,699	5,975	705,415	574,476	760	149,928	581,426	977,692	48,810	690	1,488,691	706,040

TABLE 43

(Inland Fisheries)

SUMMARY OF TROUT AND SALMON PLANTED BY SPECIES

1956-57 Fiscal Year

Species	Fingerling		Subcatchable		Catchable		Total	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Resident fish								
Trout								
Rainbow	8,882,670	55,206	603,227	57,985	7,952,626	1,608,632	17,438,523	1,721,823
Eastern brook	1,707,800	4,602					1,707,800	4,602
Brown	1,221,766	2,287			2,300	1,965	1,224,066	4,252
Cutthroat	1,419,527	1,722			258	302	1,419,785	2,024
Golden	268,000	120					268,000	120
Total trout	13,499,763	63,937	603,227	57,985	7,955,184	1,610,899	22,058,174	1,732,821
Salmon—Kokanee	211,768	668					211,768	668
Total resident fish planted	13,711,531	64,605	603,227	57,985	7,955,184	1,610,899	22,269,942	1,733,489
Anadromous fish*								
Trout—Steelhead	663,805	9,063	32,140	2,369	39,567	5,027	735,686	16,459
Salmon								
King	1,645,235	1,947	10,255	1,115	10,324	1,415	1,665,814	4,477
Silver			70,070	7,290	29,600	10,000	99,670	17,290
Total salmon	1,645,235	1,947	80,325	8,405	39,924	11,415	1,765,484	21,767
Total anadromous fish planted	2,309,040	11,010	112,639	10,774	79,491	16,442	2,501,170	38,226
Total fish planted	16,020,571	75,615	715,866	68,759	8,034,675	1,627,341	24,771,112	1,771,715

* Anadromous trout and salmon yearlings are shown as subcatchables or catchables to correspond with the resident trout size range.

TABLE 44

(Inland Fisheries)

SUMMARY OF TROUT AND SALMON PLANTED BY SPECIES

1957-58 Fiscal Year

Species	Fingerling		Subcatchable		Catchable		Total	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Resident fish								
Trout								
Rainbow	7,037,461	75,996	1,661,314	160,220	7,496,774	1,657,453	16,195,549	1,893,669
Eastern brook	1,577,699	6,350					1,577,699	6,350
Brown	705,415	1,274			5,975	1,257	711,390	2,531
Cutthroat	574,476	1,491					574,476	1,491
Golden	149,928	56			760	492	150,688	548
Total trout	10,044,979	85,167	1,661,314	160,220	7,503,509	1,659,202	19,209,802	1,904,589
Salmon—Kokanee	706,040	428					706,040	428
Total resident fish planted	10,751,019	85,595	1,661,314	160,220	7,503,509	1,659,202	19,915,842	1,905,017
Anadromous fish*								
Trout—Steelhead	977,692	3,888	133,013	12,972	448,413	32,621	1,559,118	49,481
Salmon								
King	1,488,691	4,857	690	29			1,489,381	4,886
Silver			48,810	5,676			48,810	5,676
Total salmon	1,488,691	4,857	49,500	5,705			1,538,191	10,562
Total anadromous fish planted	2,466,383	8,745	182,513	18,677	448,413	32,621	3,097,309	60,043
Total fish planted	13,217,402	94,340	1,843,827	178,897	7,951,922	1,691,823	23,013,151	1,965,060

* Anadromous trout and salmon yearlings are shown as subcatchables or catchables to correspond with the resident trout size range.

TABLE 45

(Water Projects)

WATER PROJECTS UPON WHICH ACTION WAS TAKEN DURING BIENNIUM

(Most of these projects involved extensive review, investigation, compilation of reports and recommendations, and negotiations with the project sponsors.)

Region	Project name or watershed	County
FEDERAL POWER COMMISSION PERMIT OR LICENSE APPLICATIONS		
Region 1:		
FPC No. 233	Pit River (No. 4 and No. 5)	Shasta
FPC No. 747	Pine Creek	Modoc
FPC No. 1867	Bill Berry and Swamp Creeks	Siskiyou
FPC No. 1937	Middle Creek (tributary to Scott River)	Siskiyou
FPC No. 2049 (FPC No. 2202)	Eel River Drainage (Castle Peak)	Mendocino and Trinity
FPC No. 2082	Klamath River (2200)	Siskiyou
FPC No. 2099	McCloud River	Shasta and Siskiyou
FPC No. 2106	McCloud and Pit Rivers	Shasta and Siskiyou
FPC No. 2137	Pit River	Shasta
FPC No. 2200	Klamath River	Siskiyou
FPC No. 2202 (FPC No. 2049)	Eel River Drainage (Castle Peak)	Mendocino and Trinity
Region 2:		
FPC No. 78	South Fork American River (Chute Camp)	El Dorado
FPC No. 137	Mokelumne River and tributaries	Amador, Calaveras, Alpine
FPC No. 444	North Fork Feather River	Plumas
FPC No. 1302	Long Lake and Gray Eagle Creek	Plumas
FPC No. 1962	North Fork Feather River	Butte and Plumas
FPC No. 2067	Stanislaus River	Calaveras and Tuolumne
FPC No. 2079	Middle Fork American River	Placer and El Dorado
FPC No. 2088	South Fork Feather River (Oroville-Wyandotte)	Butte, Plumas, Yuba, Sierra
FPC No. 2100	Feather River (Oroville Dam)	Butte
FPC No. 2101	Upper American River (S.M.U.D.)	El Dorado
FPC No. 2105	North Fork Feather River (Beldeo Project) (FPC No. 616, No. 1352, No. 2108)	Plumas
FPC No. 2124	Middle Fork Feather River	Butte and Plumas
FPC No. 2125	Lights and Moonlights Creeks	Plumas
FPC No. 2126	East Branch North Fork Feather River (FPC No. 2125)	Plumas
FPC No. 2128	Mokelumne River	Amador and Calaveras
FPC No. 2130	Stanislaus River	Calaveras and Tuolumne
FPC No. 2134	Middle Fork Feather River	Plumas and Butte
FPC No. 2136	Middle Fork Feather River	Plumas and Butte
FPC No. 2238	Yuba River, Dry Creek and Deer Creek	Yuba and Nevada
FPC No. 2240	North and Middle Forks Yuba River	Sierra, Nevada, Yuba
FPC No. 2246	Yuba River and tributaries	Yuba, Sierra, Nevada
Region 3:		
FPC No. 2049 (FPC No. 2202)	Eel River Drainage (Castle Peak)	Mendocino and Trinity
FPC No. 2202 (FPC No. 2049)	Eel River Drainage (Castle Peak)	Mendocino and Trinity
Region 4:		
FPC No. 67	South Fork San Joaquin River	Fresno
FPC No. 120	San Joaquin River	Fresno
FPC No. 1520	Whiskey Creek	Madera
FPC No. 1925	Kings River	Fresno
FPC No. 1930	Kern River	Kern
FPC No. 1988	North Fork Kings River and Helms Creek (FPC No. 175, No. 1990)	Fresno
FPC No. 2085	San Joaquin River (Mammoth Pool)	Fresno, Madera
FPC No. 2088	Mono Creek (FPC No. 2174, No. 2175)	Fresno
FPC No. 2130	Stanislaus River	Calaveras, Tuolumne
FPC No. 2174	San Joaquin River	Fresno
FPC No. 2179	Merced River	Merced
Region 5:		
FPC No. 176	Lake Wohlford	San Diego
FPC No. 433	North Fork Rush Creek	Mono
FPC No. 1397		Imperial
FPC No. 1764	Darwin Wash	Inyo
FPC No. 1890	Milner Creek (Owens River)	Mono
FPC No. 1932	Lytle Creek	San Bernardino
FPC No. 1933	Santa Ana River	San Bernardino
FPC No. 1934	Mill Creek	San Bernardino
FPC No. 2153	Piru Creek	Ventura and Los Angeles
FPC No. 2198	Santa Ana River	San Bernardino
U. S. BUREAU OF RECLAMATION PROJECTS		
Region 1:	Butte Valley	Siskiyou
	Cow Creek Recreation Unit	Shasta
	Klamath River Project Studies	Siskiyou, Trinity
	Upper Klamath River	Siskiyou
	Red Bluff Dam	Tehama
	Sacramento River Canals	Several
	Trinity River Project	Trinity
Region 2:	Auburn Dam	El Dorado
	Nashville Project (Cosumnes River)	El Dorado, Amador, Sacramento
	Folsom South Unit	Sacramento, San Joaquin, Stanislaus
	Monticello Reservoir	Napa, Solano and Yolo
	Sacramento River Canals (See Region 1)	Several
	Truckee River (Washoe Project)	Nevada
	Yolo Zamora Unit	Yolo
Region 3:	Guadalupe Creek	Santa Clara
	Monticello Reservoir (See Region 2)	Napa, Solano and Yolo
Region 5:	Calleguas Project	Ventura
	Colorado River	Imperial and Riverside
	Ventura River	Ventura
	Walker River Project	Mono
STATE WATER RIGHTS BOARD HEARINGS*		
Region 1:	Eagle Lake	Lassen
	McCloud River	Siskiyou and Shasta
	Mad River	Trinity
	Sacramento River	Numerous
Region 2:	American River	El Dorado and Placer
	Bear River and Coon Creek	Yuba, Placer, Nevada
(Before Water Com.)	Feather River	Plumas
	South Fork Feather River	Yuba
	Mokelumne River	Amador, Calaveras, San Joaquin
	Mokelumne River	Amador
	Putah Creek	Yolo
	Sacramento River	Numerous
	Truckee River	Nevada and Sierra
	Whaler Creek	El Dorado
Region 3:	Old Creek	San Luis Obispo
	Sacramento River	Numerous
Region 4:	San Joaquin River	Fresno
	Tuolumne and Stanislaus Rivers	Tuolumne and Stanislaus
	Sacramento River	Numerous
Region 5:	Santa Clara River, Sespe and Piru Creeks	Ventura
	Santa Margarita River	San Diego
WATERSHED AND FLOOD PREVENTION PROJECTS (Public Laws 566 and 1018)		
Region 1:	Autelope Creek	Tehama
Region 2:	Morrison Creek	Sacramento
	Bear Creek	San Joaquin
	San Juan Ridge Ditch	Nevada
	Markleeville and Indian Creeks	Alpine
Region 3:	Sonoma Creek	Sonoma
	Arroyo Grande Creek	San Luis Obispo
	Marsh Kellog Creek	Alameda and Contra Costa
	Central Sonoma	Sonoma
	Pescadero and Butano Creeks	San Mateo
	Carnadero and Llagas Creeks	Santa Clara
	Bryant Canyon	Monterey
	Adobe Creek	Lake
	Laguna Watershed	Sonoma
	Napa River	Sonoma
	Alisal Watershed	Monterey
Region 4:	Tule River	Tulare
	Firebaugh Drainage	Merced
	Los Banos Drainage	Fresno and Madera
	Upper Tehachapi Creek	Keru
	Lewis Creek	Tulare
Region 5:	San Timoteo Creek	San Bernardino and Riverside
	Upper Perris Valley	Riverside
	Salt Creek	Riverside
	Bautista Creek	Riverside
	Smith Creek	Riverside
	Small Canyon	San Bernardino
	Upper Chino Basin	San Bernardino and Riverside
	Avenue H	Los Angeles
	Buena Vista Creek	San Diego
	Mouroe and Big Dalton Canyons	Los Angeles
	Cable and Devils Creeks	San Bernardino
	Morena Reservoir	San Diego
	San Antonio Creek	Santa Barbara
	Diaz Drainage Area	Santa Barbara
	Green Canyon	Santa Barbara
	Mission Creek	Santa Barbara
	Escondido Creek	San Diego
	Coachella Valley	Riverside
	Upper Warm Creek	San Bernardino

* Includes investigations and preparations for pending hearings, as well as those in which testimony was presented.

TABLE 45—Continued

(Water Projects)

WATER PROJECTS UPON WHICH ACTION WAS TAKEN DURING BIENNIUM

Region	Project name or watershed	County
SMALL RECLAMATION PROJECTS (Public Law 984)		
Region 1:	Pit River and Ash Creek	Modoc
Region 2:	San Joaquin River	San Joaquin
	Dry and Oregon Creeks	Yuba
	Pilot and Onion Creeks	El Dorado
	Jackson Creek	Amador
	Nevada Irrigation	Nevada
	Oroville Wyandotte	Plumas
	Mill and Antelope Creeks	El Dorado
	Webber Creek Drainage	El Dorado
	Camp Far West Project, Bear River	Placer and Yuba
	French Dry Creek	Yuba
Region 3:	Arroyo Del Valle and Alameda Creeks	Alameda
	Middletown-Dry Creek	Lake
	Arroyo Del Valle and Alameda Creeks	Alameda
	Potter Valley	Mendocino
	Hernandez Project, San Benito River	San Benito
	Santa Cruz Project	Santa Cruz
	Penitencia Creek	Santa Clara
Region 4:	Alpaugh Irrigation District	Tulare and Kern
	South San Joaquin	Stanislaus and Tuolumne
Region 5:	Perris Valley	Riverside
	Santa Margarita River	San Diego
	Cachuma Reservoir	Santa Barbara
	Palo Verde Project	Riverside
	Santa Clara River	Ventura
	Santa Ynez River	Santa Barbara
	Walker River	Mono
U. S. ARMY CORPS OF ENGINEERS—FLOOD CONTROL PROJECTS		
Region 1:	None	
Region 2:	Bear River	Sacramento
	Butte Creek	Butte
	Dry Creek	Butte
	Littlejohn Creek	Calaveras
	Stony Creek	Glenn
	Truckee River	Nevada
Region 3:	Coyote Creek	Marin
	Corte Madera	Marin
	Coyote Valley Dam (Russian River)	Mendocino
	Corralitos Creek	Santa Cruz
	Dry Creek	Sonoma
	Eel River and tributaries	Mendocino
	Middle Creek	Lake
	Pajaro River	San Benito and Santa Clara
	San Francisco Bay studies	several
	San Lorenzo Creek	Alameda
	San Lorenzo River	Santa Cruz
	Walnut Creek	Contra Costa
Region 4:	Kern River (Isabella Reservoir)	Kern
	Merced River	Mariposa
	Success Reservoir (Tule River)	Tulare
	Terminus Reservoir (Kaweah River)	Tulare
Region 5:	Los Angeles Harbor	Los Angeles
	Mojave River	San Bernardino
	San Dieguito River	San Diego
	Tahcheva Creek	Riverside
	Burbank Western	Los Angeles
U. S. ARMY CORPS OF ENGINEERS—NAVIGATION PROJECTS		
Region 3:	Lagunitas Creek	Marin
	Monterey Bay Project	Monterey
	Santa Cruz Harbor	Santa Cruz
	Noyo Harbor	Mendocino
Region 5:	Long Beach Harbor and Navigation Project	Los Angeles

Region	Project name or watershed	County
STATE WATER PROJECTS AND COMPACTS		
Region 2:	California-Nevada Compact	Nevada, Alpine, etc.
	Feather River Project (Oroville Dam)	Plumas
	Biemond Plan	Several
	Cache Creek	Yolo
Region 3:	Biemond Plan (See Region 2)	
	Cache Creek (See Region 2)	
Region 4:	San Joaquin River (State Reclamation Board)	Fresno, Madera, Merced
Region 5:	West Walker River	Mono
MISCELLANEOUS WATER PROJECTS		
Region 1:	Mad River, Ruth Dam	Trinity and Humboldt
Region 2:	Calaveras River	Calaveras
	North Fork Yuba River (Indian Valley Dam)	Yuba and Sierra
	North and Middle Forks American River	Placer
Region 3:	San Lorenzo and Cull Creeks	Alameda
	Nicasio Creek	Marin
Region 4:	Cherry Valley and Eleanor Reservoirs	Tuolumne
	Hetch-Hetchy Project	Tuolumne
Region 5:	Big Santa Anita Canyon	Los Angeles
	Owens River	Inyo
APPLICATIONS TO THE DEPARTMENT OF WATER RESOURCES FOR DAM PERMITS		
Region 1:		
Dam No. 1117	Tributary Upper Lake	Modoc
245	Snowstorm Creek	Lassen
1248	Tributary Bare Creek	Lassen
1224	Chicken Spring Gulch	Shasta
Region 2:		
97-120	North Fork Feather River	Plumas
479	Tributary Dry Creek	Amador
1321	Tributary Campbell Creek	Placer
458	Tributary Arkansas Creek	Sacramento
482	Tributary Jackson Creek	Amador
483	Tributary Jackson Creek	Amador
1-39	Tributary Stoney Creek	Colusa
1009	South Fork American River	El Dorado
Region 3:		
2423-2	Tributary Dry Creek	Sonoma
1-33	Pennsylvania Creek	Solano
1602	Huntington Park Creek	San Mateo
2425	Tributary Petaluma Creek	Sonoma
1602-2	San Bruno Creek	San Mateo
2411	Tributary Suisun Creek	Napa
2426	Tributary Salmon Creek	Sonoma
656	San Benito River	San Benito
16-3	Tributary Napa River	Napa
2412	Tributary Chiles Creek	Napa
Region 4:		
676	Dutch Creek	Mariposa
1-35	Tributary West Fork Granite Creek	Madera
1-36	Tributary West Fork Granite Creek	Madera
1-37	Tributary West Fork Granite Creek	Madera
1-38	Fresno River	Madera
104-25	San Joaquin River	Fresno
735	Tributary Kern River	Kern
Region 5:		
1003-6	Pigeon Pass Creek	Riverside
87-4	Devil Creek	San Bernardino
87-5	Devil Canyon Creek	San Bernardino
854	Tributary San Marcos Creek	San Diego

TABLE 46

(Water Projects)

WATER PROJECTS CONTRACT GROUP INVESTIGATIONS

1956-1958 BIENNIUM

Project	Counties	Status	Action	Remarks
Salinity control barrier	Sacramento, Solano, Contra Costa, San Joaquin	Completed	Evaluated effect on fish and wildlife.	Report submitted.
North coastal development	Coastal counties from Sonoma north	Active	Preliminary reconnaissance study begun.	Mad River Development evaluated and reported on.
Upper Feather River	Plumas	Active	Compared proposed projects on Middle Fork.	Two reports completed. Another being written.
Yuba River	Sierra, Nevada, Yuba	Active	Evaluated effect of Indian Valley Reservoir on fish and wildlife.	Report submitted. Studies continuing on other aspects of Yuba River development.
Cache Creek	Lake, Yolo	Pending	Studied alternate proposals for development.	Report submitted. Further study planned.
San Luis Obispo County	San Luis Obispo	Completed	Evaluated effect of countywide projects on fish and wildlife.	Report submitted.
North east counties investigation	Inland counties from Colusa north	Pending	Evaluate effects on proposed projects in the area.	Field work completed. Report to be written.
West Walker	Mono	Pending	Reconnaissance surveys conducted.	Will be reactivated at Water Resources request.
Shasta County investigation	Shasta	Completed	Determined minimum flows necessary for anadromous fish in Cottonwood and Cow Creeks.	Report being reviewed by Department of Fish and Game.
Shasta Valley investigation	Siskiyou	Completed	Appraisal of fishing pressure on Siskiyou County Reservoir.	Combined with Department of Water Resources Recreation Report.
Calaveras County investigation	Calaveras	Active	Evaluate effect of water development of Stanislaus River Basin.	Field work nearly complete. Report to be combined with Department of Water Resources.

TABLE 47

(Game Management)

GAME BAG—1954-1957

From Statewide Mail Survey

Species	1956 season bag	1957 season bag	4-year average bag 1954-57
Pheasants (cocks)	613,800	630,500	587,300
Pheasants (hens)	130,600	145,000	[1]133,900
Pheasants (total)	740,400	775,500	[2]
Quail	1,153,400	1,648,800	1,395,400
Chukar partridge	3,800	7,400	4,300
Sage grouse	2,200	3,700	2,700
Sierra and ruffed grouse	600	1,900	[3]
Doves	2,808,600	3,233,900	2,768,500
Band-tailed pigeons	96,500	255,000	151,900
Ducks	3,526,300	4,025,000	3,575,500
Geese	343,200	366,900	369,300
Coots	389,900	488,800	458,100
Jack snipes	44,300	43,600	30,500
Jack rabbits	908,000	874,200	1,056,100
Cottontail and brush rabbits	356,000	412,900	433,000
Tree squirrels	41,700	79,600	48,500
Bears	3,800	3,600	4,200
Wild boar	500	800	[4]

[1] Hens legal since 1955.
[2] In 1954 cocks only legal.
[3] Legal in 1956 and 1957.
[4] Records kept in 1956 and 1957.

TABLE 48

(Game Management)

PHEASANT HUNTING ON STATE AND FEDERAL WATERFOWL MANAGEMENT AREAS

Region	Area	Permits issued		Birds bagged		Birds bagged per hunter	
		1956	1957	1956	1957	1956	1957
1	Honey Lake	593	686	392	392	0.66	0.57
2	Gray Lodge	1,884	1,424	1,788	1,816	0.95	1.28
2	Grizzly Island	2,261	2,544	255	378	0.11	0.15
4	Los Banos	865	738	201	152	0.23	0.21
4	Mendota	1,802	1,874	1,049	579	0.70	0.31
2	Colusa National	632	1,344	234	151	0.37	0.11
2	Sutter National	885	1,025	279	531	0.32	0.52
4	Merced National	616	340	132	54	0.21	0.15
	Totals	9,238	9,975	4,330	4,053	0.47	0.41

TABLE 49

(Game Management)

WATERFOWL MANAGEMENT AREA OPERATIONS

Region	Area	Acreage open to hunting		Scheduled seasonal shooter capacity		*Actual number of hunters using area		Number of waterfowl bagged		Average bag per hunter	
		1956	1957	1956	1957	1956	1957	1956	1957	1956	1957
1	Madeline Plains	2,000	2,000	8,000	9,500	173	No data	489	No data	2.8	No data
1	Honey Lake	3,000	3,000	5,700	6,300	1,695	2,147	3,254	3,699	1.9	1.7
2	Gray Lodge	3,000	3,000	3,200	3,600	4,797	4,793	18,909	17,745	3.9	3.7
2	Colusa	1,100	1,100	2,560	6,540	3,354	6,338	12,658	18,864	3.8	3.0
2	Sutter	1,500	1,500	3,000	2,880	4,672	4,133	20,103	13,814	4.3	3.3
2	Grizzly Island	5,000	5,000	19,000	21,000	12,956	14,829	45,463	50,391	3.5	3.4
4	Merced	1,000	1,300	2,300	2,400	1,513	1,682	3,915	4,670	2.6	2.8
4	Los Banos	1,530	1,530	3,040	3,120	3,556	3,391	9,457	7,273	2.7	2.1
4	San Luis Wasteway	1,500	1,500	3,800	4,200	3,997	4,266	10,961	12,953	2.7	3.0
4	Mendota	2,500	7,500	5,700	9,750	5,070	7,764	9,948	21,460	2.0	2.8
5	Imperial†	3,840	4,000	13,700	11,880	6,862	6,650	15,413	13,423	2.2	2.0
	Totals	25,970	31,430	70,000	81,170	48,648	55,993	150,570	164,292	3.1	2.9

* Actual number of hunters may exceed scheduled capacity due to hunters using areas as replacements of original hunters who have left the area.
† Includes Hazard, Pumice, Poe, Finney-Ramer, Wister and Imperial National Units.

TABLE 50

(Game Management)

CO-OPERATIVE PHEASANT HUNTING AREA OPERATIONS

Region	Area	Acreage open to hunting		Scheduled seasonal shooter capacity		*Actual number of hunters using area		Number of pheasants bagged		Average birds bagged per hunter	
		1956	1957	1956	1957	1956	1957	1956	1957	1956	1957
1	McArthur	7,200		8,000		1,696		859		0.51	
2	Butte Creek	4,493	4,045	6,000	7,216	5,741	5,837	1,774	2,153	0.31	0.37
2	Courtland	4,101	4,768	4,000	4,800	3,919	3,693	1,529	1,317	0.39	0.36
2	Grimes	7,467	9,953	5,600	6,400	*3,417	*3,208	2,060	1,443	0.60	0.45
2	Natomas	5,270	5,500	7,200	6,400	10,027	8,298	3,462	2,653	0.35	0.32
2	Plainfield	5,468		4,800		4,866		2,222		0.46	
2	Ryer Island	11,079	11,416	11,200	11,232	5,443	5,145	2,637	2,331	0.48	0.45
2	Sherman Island	7,008	7,305	6,600	6,784	6,175	6,405	2,277	2,482	0.37	0.39
2	Staten Island	7,515	7,400	7,500	7,680	5,157	4,833	2,266	1,975	0.44	0.41
2	Twitchell Island	5,679	5,201	5,400	4,736	4,594	4,464	1,905	1,676	0.41	0.38
2	Tyler Island	6,344	5,864	6,200	5,792	5,034	4,125	2,225	1,741	0.44	0.42
4	Firebaugh	20,800	14,700	9,600	12,800	6,132	7,996	3,945	4,338	0.65	0.54
4	Merced	7,700	7,944	6,400	9,600	4,633	4,795	2,102	2,099	0.45	0.44
5	Etiwanda	5,000	7,000	8,000	5,219	16,041	10,305	6,377	5,736	0.40	0.56
5	Lakeside	5,000	5,000	4,000	4,000	5,239	3,697	3,228	2,670	0.62	0.72
	Totals	110,124	96,096	100,500	92,659	88,114	72,801	38,868	32,614	0.44	0.45

* Daily permits only.

TABLE 51

(Game Management)

GAME BIRD RELEASES

Liberation of Game Farm Chinese Ringneck Pheasants

County	1956	1957
Alameda	316	378
Alpine	160	200
Butte	3,039	3,189
Colusa	1,243	1,288
Contra Costa	--	20
Fresno	5,506	4,159
Glenn	525	650
Humboldt	131	89
Imperial	4,515	4,537
Inyo	2,429	2,772
Kern	3,456	2,741
Kings	350	291
Lake	--	164
Lassen	700	720
Madera	1,250	832
Merced	5,093	4,371
Modoc	240	240
Monterey	1,420	1,520
Napa	157	258
Nevada	40	44
Orange	50	--
Placer	200	--
Plumas	--	50
Riverside	2,700	3,120
Sacramento	7,499	11,645
San Bernardino	7,680	7,451
San Diego	3,100	3,081
San Joaquin	2,843	2,991
San Luis Obispo	953	16
San Mateo	--	75
Shasta	1,031	1,030
Siskiyou	729	870
Solano	5,291	5,389
Sonoma	1,772	2,071
Stanislaus	572	701
Sutter	7,346	1,485
Tehama	75	223
Tulare	759	1,775
Yolo	3,013	1,741
Yuba	600	150
Total	76,783	72,327

TABLE 52

(Game Management)

CONTROLLED DEER HUNT DATA

Year	Year	
	1956	1957
Number of hunts	8	9
Permit quota	4,575	5,950
Permits sold	3,941	5,729
Males bagged	434	504
Females bagged	1,994	2,349
Unclassified bagged	69	26
Total bagged	2,497	2,879

TABLE 53

(Game Management)

CALIFORNIA REGULAR SEASON BUCK DEER KILL

(Archery Tags Included)

County of kill	Yearly average 1952-1956	1956	1957	Percent change from 1952-56 average
Alameda	696	538	451	−35.2
Alpine	1,579	1,318	1,163	−26.3
Amador	436	407	317	−27.3
Butte	1,086	1,152	1,234	+13.6
Calaveras	548	601	524	−4.4
Colusa	494	435	481	−2.6
Contra Costa	221	187	176	−20.4
Del Norte	45	63	57	+26.7
El Dorado	1,318	1,437	1,119	−15.1
Fresno	2,372	2,129	2,166	−8.7
Glenn	734	859	811	+10.5
Humboldt	3,475	3,393	3,631	+4.5
Imperial	15	16	5	−66.7
Inyo	497	486	564	+13.5
Kern	975	1,107	1,303	+33.6
Kings	39	46	36	−7.7
Lake	2,252	2,030	1,585	−29.6
Lassen	2,715	4,086	3,252	+19.8
Los Angeles	861	1,122	875	+1.6
Madera	777	693	816	+5.0
Marin	875	707	548	−37.4
Mariposa	278	246	458	+64.7
Mendocino	4,503	4,051	3,847	−14.6
Merced	355	256	99	−72.1
Modoc	2,475	4,817	4,034	+63.0
Mono	1,875	1,373	2,237	+19.3
Monterey	2,339	2,585	1,976	−15.7
Napa	1,248	1,144	1,045	−16.3
Nevada	1,217	937	872	−28.3
Orange	172	181	169	−1.7
Placer	692	741	535	−22.7
Plumas	2,235	1,915	1,720	−23.0
Riverside	449	405	558	+24.3
Sacramento	23	34	23	----------
San Benito	1,398	1,233	885	−36.7
San Bernardino	550	630	1,037	+88.5
San Diego	1,048	1,040	1,018	−2.9
San Joaquin	58	53	51	−12.1
San Luis Obispo	1,770	2,222	1,794	+1.4
San Mateo	147	134	180	+22.4
Santa Barbara	1,179	1,571	1,384	+17.4
Santa Clara	1,318	1,239	1,027	−22.1
Santa Cruz	192	202	193	+0.5
Shasta	2,902	3,415	3,150	+8.5
Sierra	989	782	702	−29.0
Siskiyou	3,772	5,651	4,396	+16.5
Solano	134	147	130	−3.0
Sonoma	1,620	1,303	1,267	−21.8
Stanislaus	454	369	313	−31.1
Sutter	1	3	----------	−100.0
Tehama	2,998	3,116	3,195	+6.6
Trinity	1,387	1,618	1,633	+17.7
Tulare	1,360	1,284	1,717	+26.3
Tuolumne	1,251	889	933	−25.4
Ventura	947	1,138	847	−10.6
Yolo	377	275	257	−31.8
Yuba	261	323	372	+42.5
Not given	145	237	46	−68.3
Statewide totals	66,129	70,371	65,214	−1.4
Deer tag sales	399,305	448,666	420,500 Estimated	+10.6

TABLE 54

(Game Management)

DEPARTMENT LAND WITHDRAWALS PROGRAM

STATUS—1958

Region	Name	Purpose	County	Acres
	Withdrawals complete—public land orders issued			
1	Madeline Plains	Waterfowl area	Lassen	640.00
1	Honey Lake Dakin No. 1	Waterfowl area	Lassen	673.65
1	Honey Lake Dakin No. 2	Waterfowl area	Lassen	185.18
1	Tower House Springs	Band-tailed pigeon area	Shasta	570.00
5	Topaz Lake	Trout fishing access	Mono	200.00
	Total			2,268.83
	Pending withdrawals			
1	Mt. Dome	Deer range	Siskiyou	22,275.88
1	Copco Lake	Trout fishing access	Siskiyou	200.00
1	Klamath River	Trout and salmon fishing	Siskiyou	40.00
1	King's Peak	Deer range	Humboldt	20,764.32
1	Cinder Cone	Deer range	Shasta	27,703.94
1	Yolla Bolly	Deer range	Tehama	4,620.00
1	Madeline Reservoir	Waterfowl area	Lassen	1,361.32
1	Biscar Reservoir	Waterfowl area	Lassen	4,965.19
1	Goat Island	Trout and salmon fishing	Shasta	59.80
1	Hay Fork	Deer range	Trinity	2,744.45
2, 3	Clear Lake No. 1	Deer range, upland game	Napa, Lake, Colusa, Yolo	41,304.33
2, 3	Clear Lake No. 2	Deer range, upland game	Napa, Colusa, Lake	59,507.49
2, 3	Clear Lake No. 3	Deer range, upland game	Napa, Yolo, Glenn	11,704.98
3, 4	Panoche	Upland game range	Fresno, San Benito	49,120.99
3, 4	New Idria	Upland game, deer range	Fresno, San Benito, Monterey	62,154.70
3, 4	Temblor	Upland game range	Kern, San Luis Obispo	57,361.02
3, 4	Caliente	Upland game range	Kern, San Luis Obispo	58,111.45
5	McCain Valley	Upland game, deer range	San Diego	38,691.57
5	Otay Mountain	Upland game, deer range	San Diego	15,436.85
5	Jacumba	Upland game	San Diego	6,400.04
5	Rattlesnake Canyon	Upland game, deer range	San Bernardino	22,395.08
5	Lower Colorado River	Upland game, big game range	Riverside, Imperial	46,649.56
	Total			553,572.96

TABLE 55

(Game Management)

SUMMARY OF DEPARTMENT OF FISH AND GAME LANDS—1958

Game Branch

	Acreage leased	Acreage owned	Cost
Waterfowl management areas			
Sheepy Ridge, Siskiyou County		320.00	$1,034.00
Madeline Plains, Lassen County		5,176.10	47,353.20
Honey Lake, Lassen County		4,819.70	90,784.09
Gray Lodge, Butte and Sutter Counties		6,735.51	1,044,297.77
Grizzly Island, Solano County		8,600.00	659,929.42
Suisun, Solano County		1,887.00	71,875.50
Los Banos, Merced County		3,000.00	104,241.40
San Luis Wasteway, Merced County	2,886.95		
Mendota, Fresno County		8,536.57	1,071,675.49
Finney-Ramer, Imperial County		2,064.43	88,405.05
Hazard-Fleet, Imperial County	89.95	535.24	47,775.52
Wister, Imperial County	3,640.00	5,563.00	954,589.08
Totals	6,616.90	47,237.55	$4,181,960.52
Winter deer ranges			
Doyle, Lassen County		13,502.91	$37,807.76
Tehama, Tehama County		42,896.90	212,518.86
Totals		56,399.81	$250,326.62
Game Farms			
Redding, Shasta County		14.00	$4,294.00
Chico, Butte County	Gift	12.00	
Marysville, Yuba County	Gift	11.00	
Sacramento, Sacramento County	14.48		
Yountville, Napa County		72.00	
Fresno, Fresno County	40 (approx.)		
Los Serranos, San Bernardino County	Gift	29.00	
Brawley, Imperial County—part of Finney-Ramer			
Valley Center, San Diego County	13 (approx.)		
Totals	67.48	138.00	$4,294.00
Totals—Waterfowl Management Areas	6,616.90	47,237.55	$4,181,960.52
Winter Deer Ranges		56,399.81	250,326.62
Game Farms	67.48	138.00	4,294.00
Grand total	6,684.38	103,775.36	$4,436,581.14

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printed in CALIFORNIA STATE PRINTING OFFICE

89962 1-59 10M

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME
722 Capitol Avenue
SACRAMENTO 14, CALIFORNIA

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